

حمل الآن

مجاناً وحصرياً

# المراجعة رقم (1)

## الترم الاول



|                                             |                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Environment</b>                          | <ul style="list-style-type: none"> <li>* A term is derived from the French word "Environ" which means "what surrounds us".</li> <li>* It is everything that surrounds us, including biotic factors (such as humans, plants, animals and microorganisms) and abiotic factors (such as light, air, water, and soil).</li> </ul> |
| <b>Ecosystem</b>                            | It is a community of living organisms that interact with each other and with non-living components for adapting to the changeable conditions.                                                                                                                                                                                 |
| <b>Water cycle<br/>(Hydrological cycle)</b> | It is the continuous movement of water (on or near the Earth's surface) from one place to another around the planet in an almost closed system through many different pathways, changing between its three states (solid, liquid, and gas) within the known temperature range on the Earth's surface.                         |
| <b>Transpiration</b>                        | It is the process by which the plant gets rid of excess water in the form of vapor from the plant's surface exposed to air.                                                                                                                                                                                                   |
| <b>Stomata</b>                              | They are microscopic openings found on the surfaces of leaves and green stems through which most transpiration occurs.                                                                                                                                                                                                        |
| <b>Excretion</b>                            | It is the process by which a living organism gets rid of waste products resulting from metabolic processes, such as carbon dioxide, water vapor, and nitrogenous wastes (such as ammonia, urea and uric acid).                                                                                                                |



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| <b>Covalent bond</b>                           | A type of chemical bonds that binds between two atoms by sharing electrons where each atom shares one or more electron to form the bond.                                                                    |
| <b>Hydrogen bond among water molecules</b>     | An electrostatic attraction between a partially positive hydrogen atom ( $\delta^+$ ) in one of the water molecules and a partially negative oxygen atom ( $\delta^-$ ) in an adjacent water molecule.      |
| <b>Electronegativity</b>                       | A measurement for the atom's ability to attract the electrons of the chemical bond towards itself for a longer period of time.                                                                              |
| <b>Hydrolysis of salts</b>                     | <p>A reaction occurs when a solid salt is dissolved in water forming an acid and a base one or both of which are weak.</p> <p>Water (liquid) + Salt (solid) <math>\rightleftharpoons</math> Base + Acid</p> |
| <b>The pH value of the solution (pH scale)</b> | A quantitative measurement with values ranging from 0 to 14, that expresses the degree of acidity, neutrality or alkalinity of the liquid or the solution.                                                  |
| <b>Neutral solution</b>                        | A solution in which the concentration of hydrogen ions is equal to the concentration of hydroxide ions.                                                                                                     |
| <b>Basic solution</b>                          | A solution in which the concentration of hydrogen ions is less than the concentration of hydroxide ions.                                                                                                    |
| <b>Acidic solution</b>                         | A solution in which the concentration of hydrogen ions is greater than the concentration of hydroxide ions.                                                                                                 |
| <b>Fluid</b>                                   | Any substance that can flow and does not have a fixed shape, but takes the shape of the container that holds it.                                                                                            |
| <b>Density</b>                                 | The mass of a unit volume of a substance at a specific temperature.                                                                                                                                         |

|                                               |                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Relative density of a substance</b>        | The ratio of the density of a substance to the density of pure water at a temperature of 4°C.                                                                                                                                                                                                                                                                                |
| <b>Internal energy of a body or a system</b>  | The sum of the kinetic and potential energies of the molecules of the body or the system.                                                                                                                                                                                                                                                                                    |
| <b>Temperature</b>                            | <ul style="list-style-type: none"> <li>* A quantitative description of how hot or cold a body or a system is.</li> <li>* A measure of the average kinetic energy of the molecules of a body or a system.</li> </ul>                                                                                                                                                          |
| <b>Amount of heat</b>                         | The thermal energy transferred from, to or within a body when there is a difference in temperature.                                                                                                                                                                                                                                                                          |
| <b>Specific heat of a substance</b>           | The amount of heat required to raise the temperature of 1 kg of a substance by one degree Celsius or one kelvin.                                                                                                                                                                                                                                                             |
| <b>Latent heat of vaporization</b>            | <ul style="list-style-type: none"> <li>* The thermal energy released from a unit mass (1 kg) of a substance as it transforms from a gaseous state to a liquid state without a change in temperature.</li> <li>* The thermal energy absorbed by a unit mass of a substance to transform it from a liquid state to a gaseous state without a change in temperature.</li> </ul> |
| <b>Warm-blooded organisms</b>                 | They are organisms that can maintain a constant internal body temperature regardless the temperature of the surrounding environment.                                                                                                                                                                                                                                         |
| <b>Cold-blooded organisms</b>                 | They are organisms that rely on external sources to regulate their body temperature.                                                                                                                                                                                                                                                                                         |
| <b>Solution</b>                               | A homogeneous mixture which consists of solvent and solute.                                                                                                                                                                                                                                                                                                                  |
| <b>The colligative properties of solution</b> | They are properties of the solution that depend on the number of ions or molecules of the non-volatile dissolved substance (solute) in the solution, not on the type of the solute.                                                                                                                                                                                          |



|                                     |                                                                                                                                                                                                                                                                                                                                                             |
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| <b>Vapor pressure</b>               | It is the liquid vapor pressure on the liquid surface in a closed container (system), when the liquid and its vapor are on dynamic equilibrium at a constant temperature and pressure.                                                                                                                                                                      |
| <b>Dynamic equilibrium</b>          | The equilibrium between the evaporation rate of the liquid and the condensation rate of its vapor at constant temperature and pressure in a closed container (system).                                                                                                                                                                                      |
| <b>Boiling point of the liquid</b>  | The temperature at which vapor pressure of the liquid is equal to the atmospheric pressure exerted on the liquid surface.                                                                                                                                                                                                                                   |
| <b>Freezing point of the liquid</b> | The temperature at which the substance is converted from the liquid state into solid state.                                                                                                                                                                                                                                                                 |
| <b>Osmosis</b>                      | It is the phenomenon of transferring (movement) of water from the diluted solution to the concentrated solution through a semi-permeable membrane separating the two solutions.                                                                                                                                                                             |
| <b>Osmotic pressure</b>             | It is the pressure that arises in a solution due to the difference in dissolved substances (solutes) concentration between two solutions, which leads to the diffusion of water by osmosis from the low-concentrated solution (with low osmotic pressure) to the high-concentrated solution (with high osmotic pressure) through a semi-permeable membrane. |
| <b>Cell</b>                         | <ul style="list-style-type: none"> <li>* It is the basic unit of life, representing the structural and functional unit of all living organisms.</li> <li>* It is the smallest independent constituent in the structure of a multicellular organism.</li> </ul>                                                                                              |
| <b>Prokaryotes</b>                  | They are unicellular organisms whose genetic material is not surrounded by a nuclear membrane.                                                                                                                                                                                                                                                              |

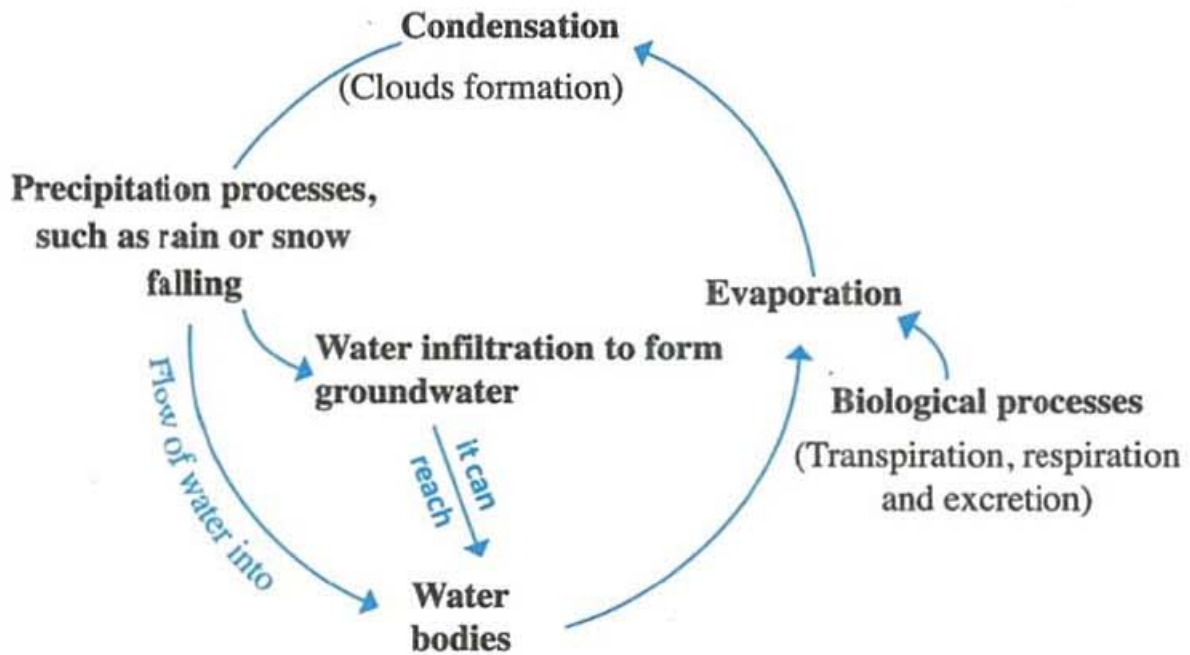
|                                               |                                                                                                                                                                                                                                                                                                                                                         |
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| <b>Eukaryotes</b>                             | They are unicellular or multicellular living organisms whose genetic material is surrounded by a nuclear membrane and contain specialized organelles.                                                                                                                                                                                                   |
| <b>Enzymes</b>                                | They are specific catalysts or activators composed of protein substances that increase the speed of chemical reactions in the cell.                                                                                                                                                                                                                     |
| <b>Metabolic processes (Metabolism)</b>       | They are a set of continuous biochemical reactions that occur inside the cells of living organisms, taking place in the presence of water, on which the life of living organisms depends.                                                                                                                                                               |
| <b>Activation energy</b>                      | It is the minimum amount of energy required to start a chemical reaction.                                                                                                                                                                                                                                                                               |
| <b>Adaptation</b>                             | It refers to the behavioral or physical traits of a living organism that help it to survive better in its ecosystem.                                                                                                                                                                                                                                    |
| <b>Structural (Anatomical) adaptations</b>    | They include changes in the structure and shape of parts of a living organism's body that help it to survive in its environment.                                                                                                                                                                                                                        |
| <b>Behavioral adaptations</b>                 | They include certain behaviors or actions, whether inherited or acquired, that help living organisms to face the harsh conditions or to better utilize available resources.                                                                                                                                                                             |
| <b>Physiological (Functional) adaptations</b> | They are adaptations or modifications in the way living organisms perform their vital functions which enable them to survive in their environments.                                                                                                                                                                                                     |
| <b>Solubility</b>                             | <ul style="list-style-type: none"> <li>* It is the ability of a solute to dissolve in a solvent to form a homogeneous solution at a specific temperature and pressure.</li> <li>* It is the maximum amount of solute required in a specific volume of solvent to form a saturated and stable solution at a certain temperature and pressure.</li> </ul> |



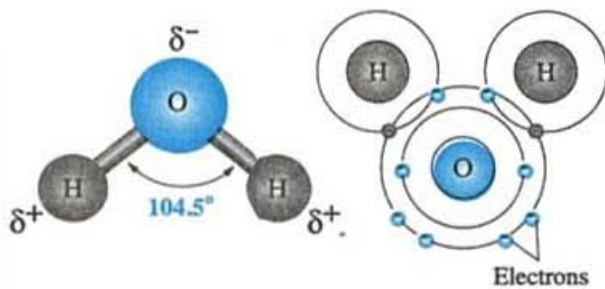
|                                                  |                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Photosynthesis</b>                            | It is a vital process carried out by autotrophic organisms such as phytoplankton, algae and aquatic plants, during which organic substances such as carbohydrates like glucose are formed in the presence of light and chlorophyll. It plays a role in the production of oxygen. |
| <b>Diffusion</b>                                 | It is the movement of molecules or ions from the medium with a high concentration to the medium with a low concentration.                                                                                                                                                        |
| <b>Acidification</b>                             | It is reducing the pH value of water as a result of forming acids such as carbonic acid ( $\text{H}_2\text{CO}_3$ ) that is produced from the dissolution of $\text{CO}_2$ gas in water.                                                                                         |
| <b>Calcification</b>                             | It is a process that many marine organisms rely on to form their shells or skeletal structures from calcium carbonate (which is slightly soluble in water).                                                                                                                      |
| <b>Gulf stream</b>                               | One of the ocean currents that carries warm water from the equator towards the North Atlantic Ocean.                                                                                                                                                                             |
| <b>Pressure of a liquid at a point inside it</b> | The weight of the column of liquid above that point acting on the unit area around that point.                                                                                                                                                                                   |
| <b>Swim (Air) bladder</b>                        | It is an organ in some fish that is filled with gases to allow them to control their buoyancy in the water.                                                                                                                                                                      |
| <b>Ecological balance</b>                        | It is a state of dynamic stability that occurs when living organisms in an ecosystem interact with non-living components in a way that sustains the continuity of life.                                                                                                          |
| <b>Sustainable development</b>                   | Meeting the needs of the current generation without compromising the ability of future generations to meet their own needs.                                                                                                                                                      |

## 2 Illustrating figures and diagrams

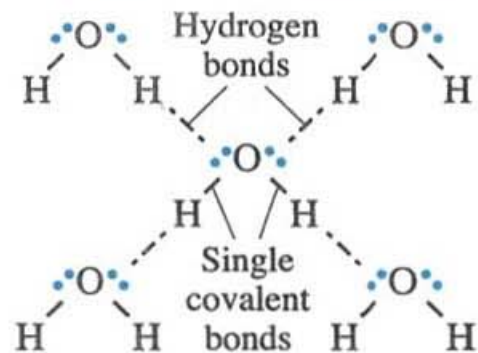
### 1 Water cycle in nature



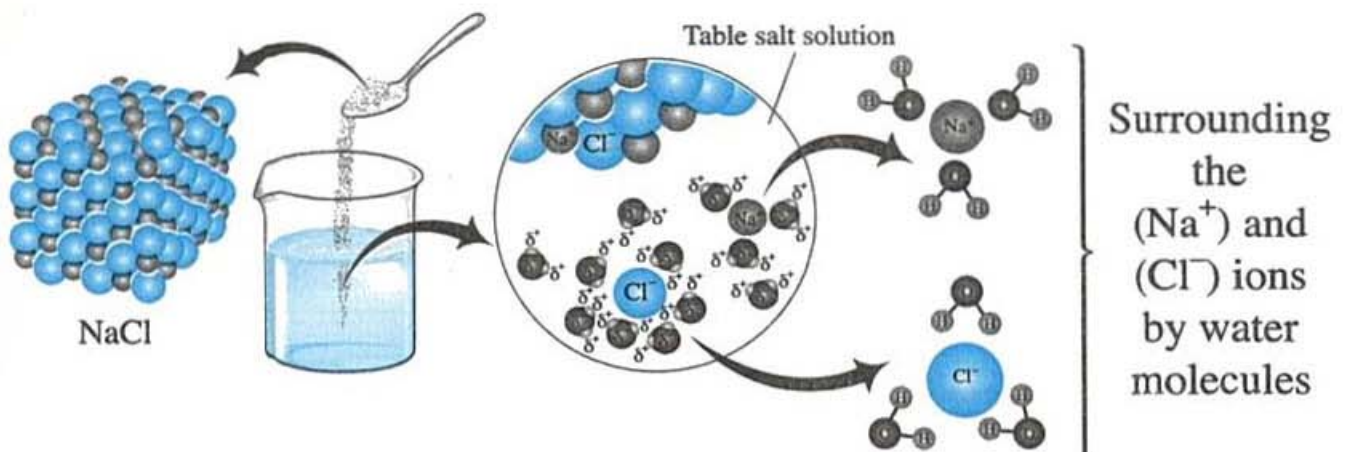
### 2 The structure of water molecule



### 3 The types of chemical bonds in water



### 4 Dissociation of sodium chloride salt ( $NaCl$ ) in water





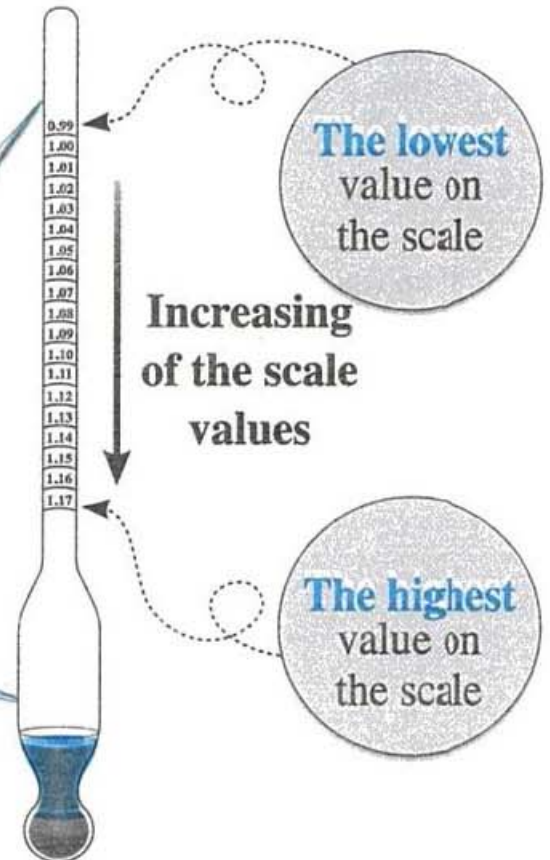
## 5 Hydrometer

### 1 A long glass stem

with a small diameter, graduated with the values of relative density or density in  $\text{g/cm}^3$ .

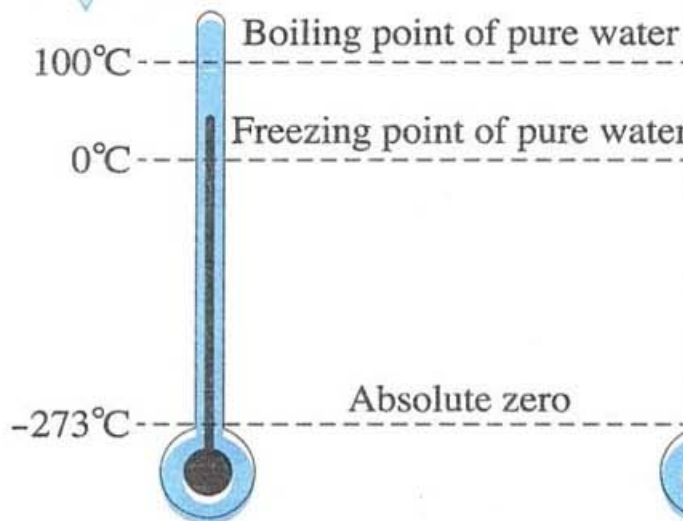
### 2 A cylindrical glass bulb

which is a wider hollow sealed reservoir for buoyancy, that contains at its bottom mercury or lead balls to help the device balance vertically in liquids.



## 6 Some measuring units of temperature

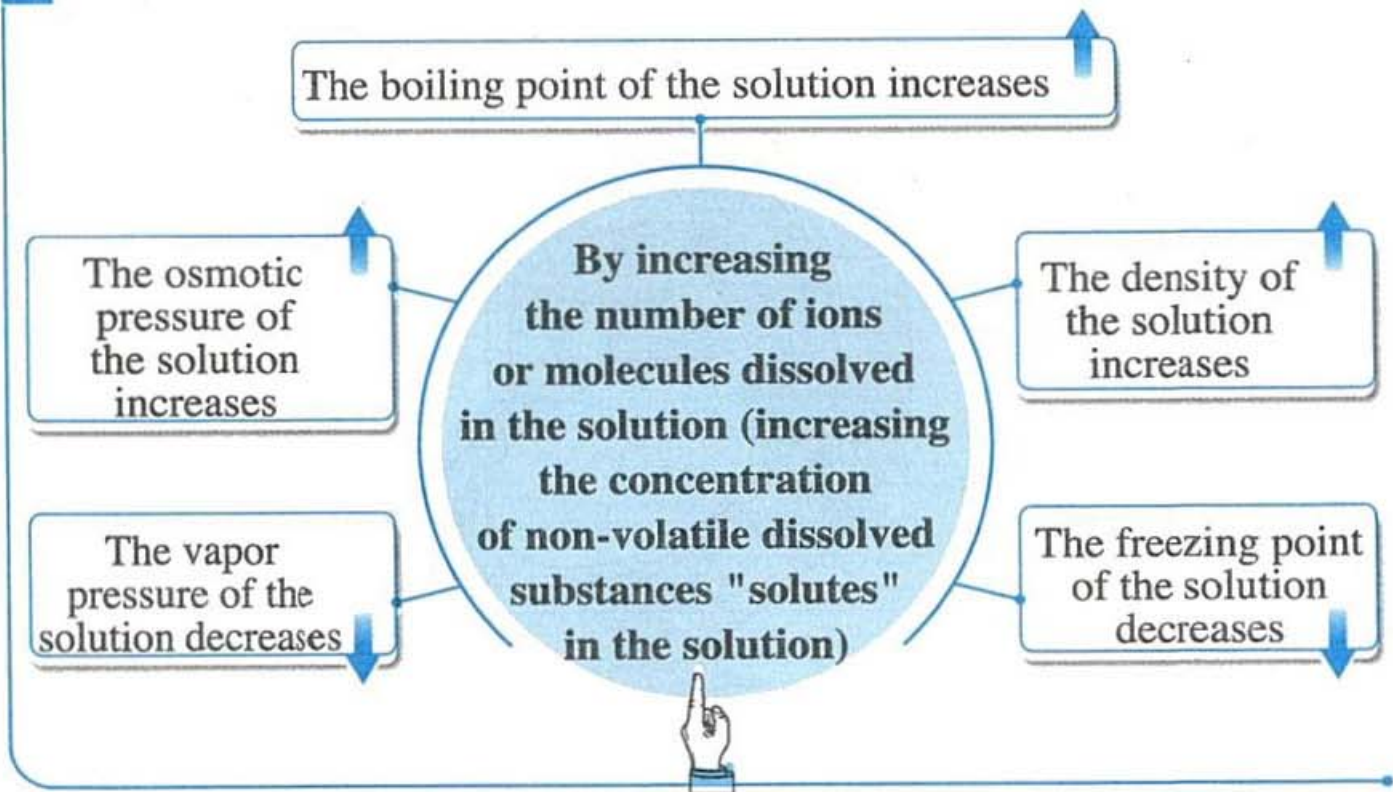
### Celsius ( $^{\circ}\text{C}$ )



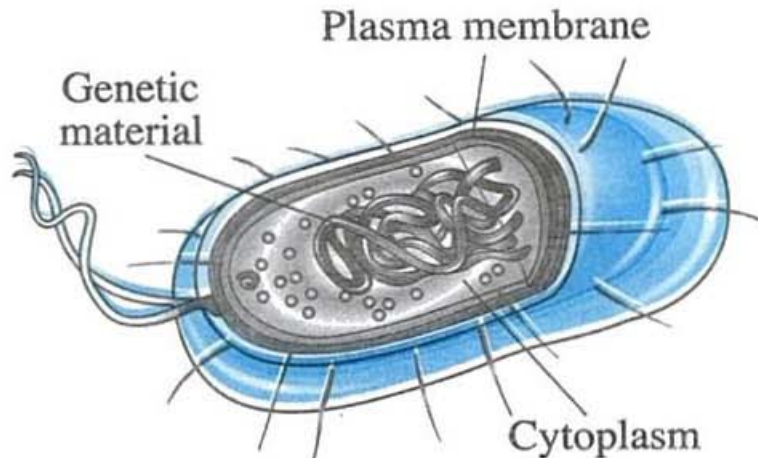
### Kelvin (K)



7

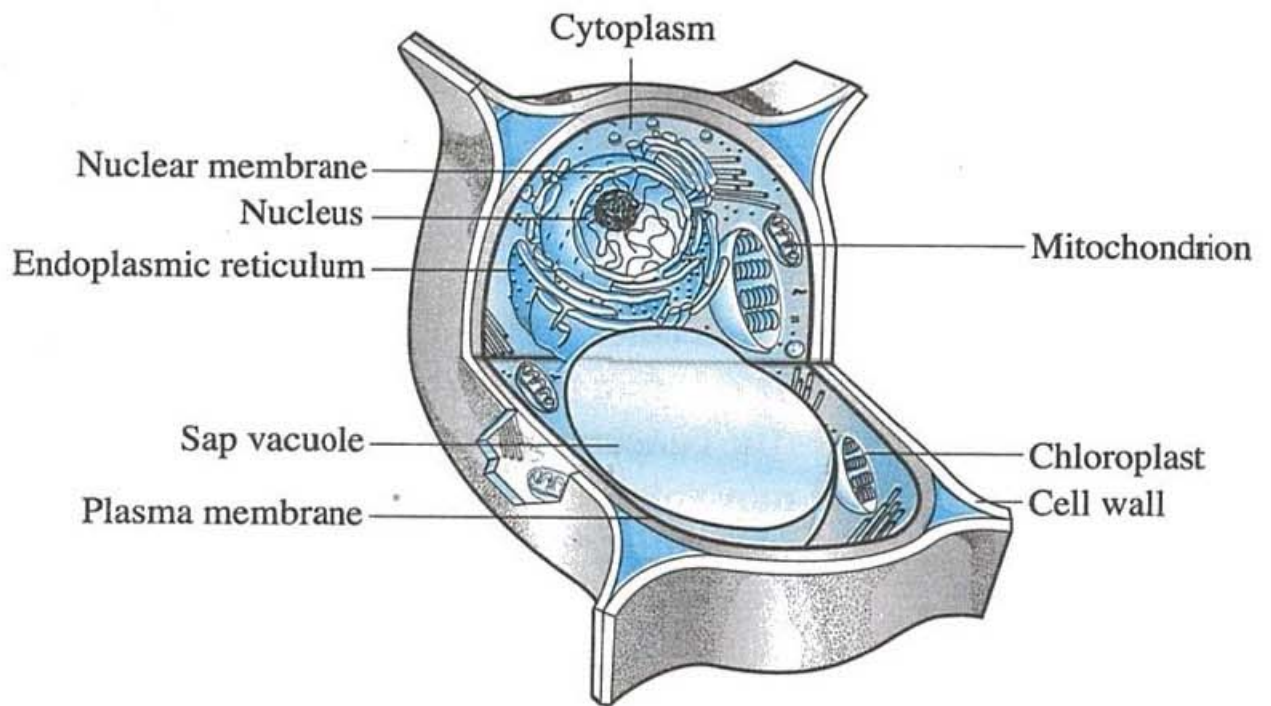


## 8 Bacterial cell

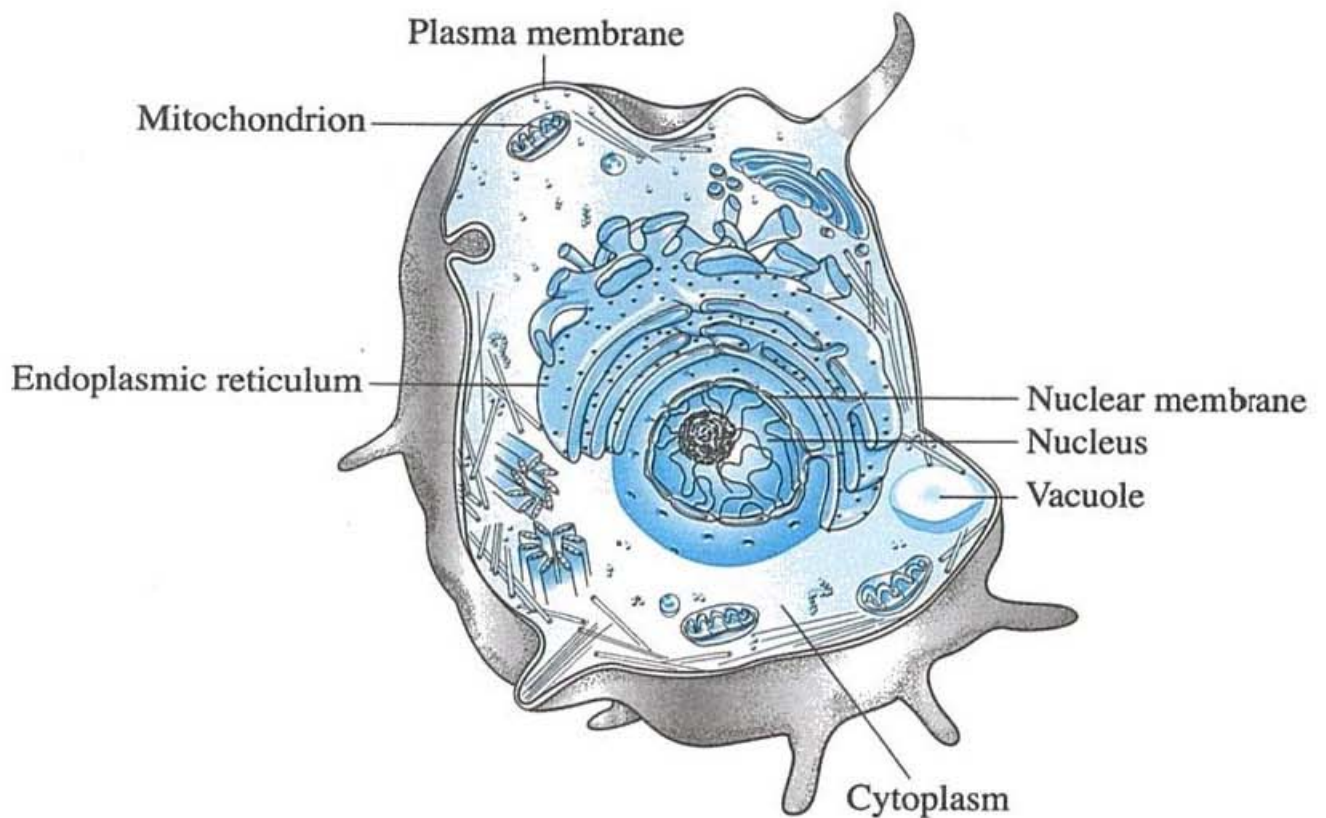




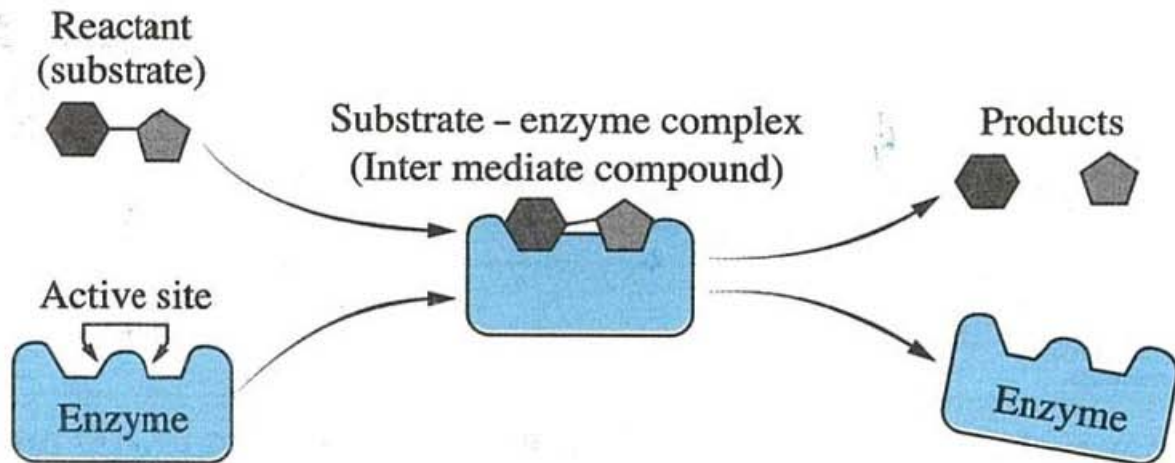
## 9 Plant cell



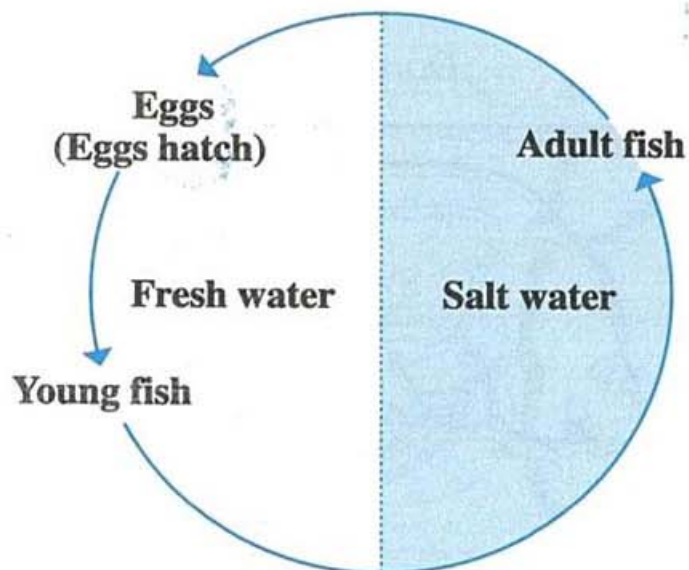
## 10 Animal cell



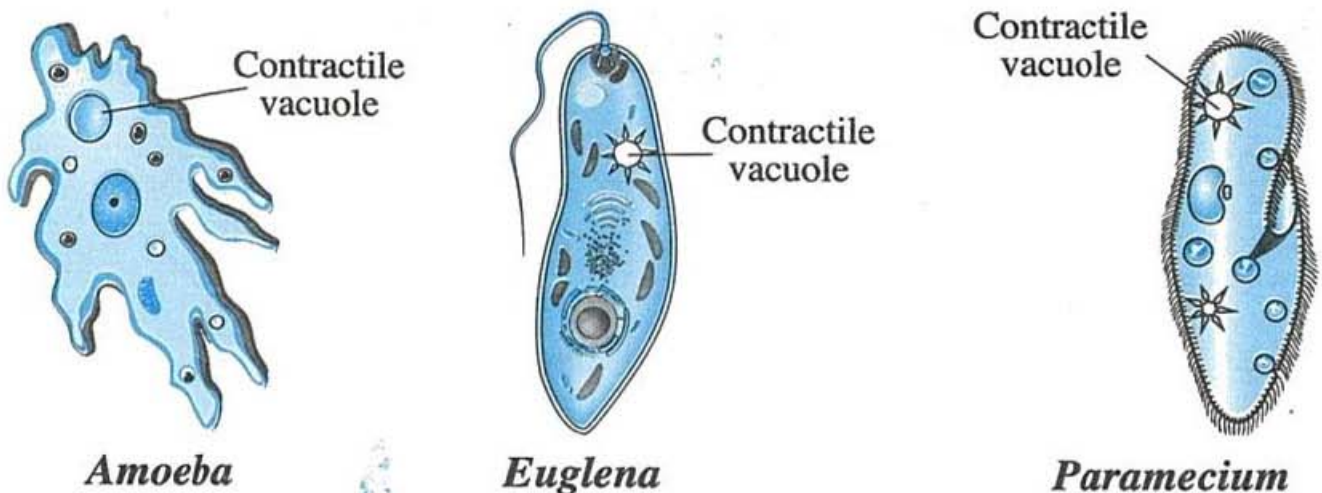
## 11 Mechanism of the enzyme's action [as a catalyst]



## 12 Life cycle of salmon fish

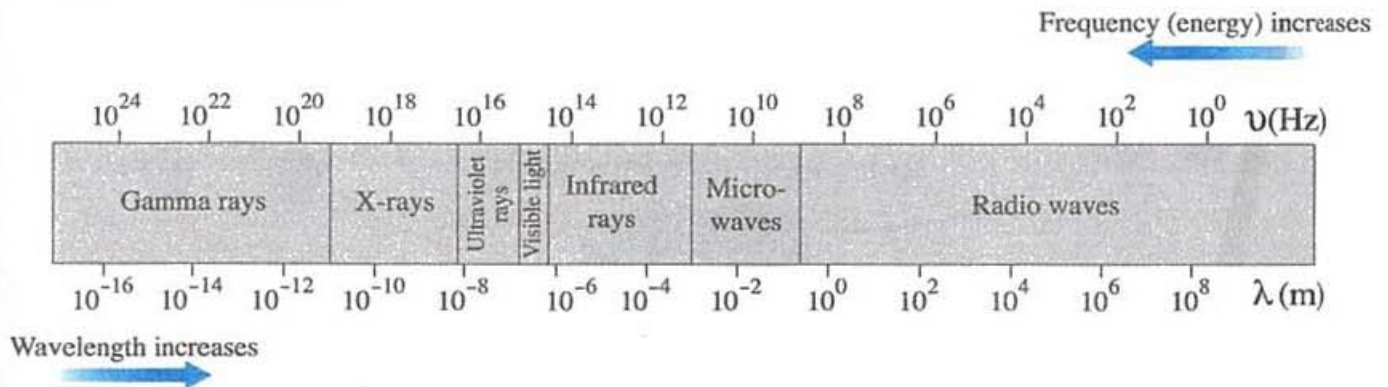


## 13 Contractile vacuole in some unicellular organisms



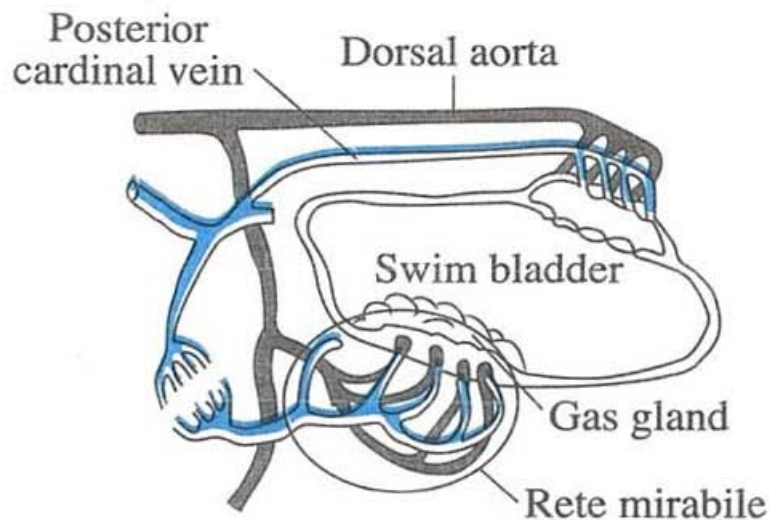


## 14 The electromagnetic spectrum



\* The wavelengths of visible light range from 400 nm to 700 nm.

## 15 Air [Gas] bladder or swim sac

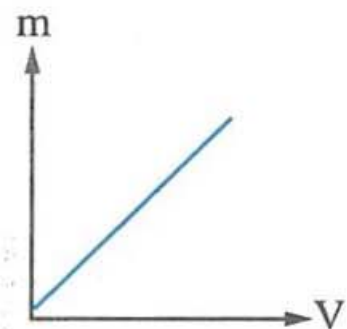


## 3 Graphical relations

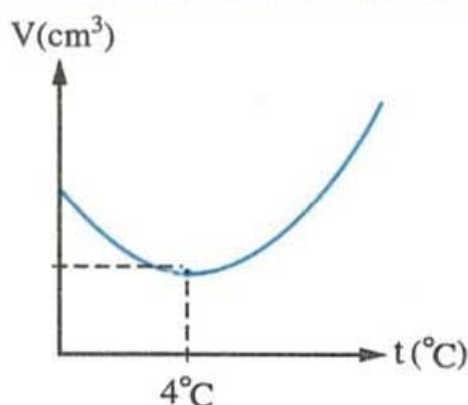
### 1 The relation between the mass [m] and the volume [V] for a group of bodies of the same substance at the same temperature

\* The relation:  $\rho = \frac{m}{V}$

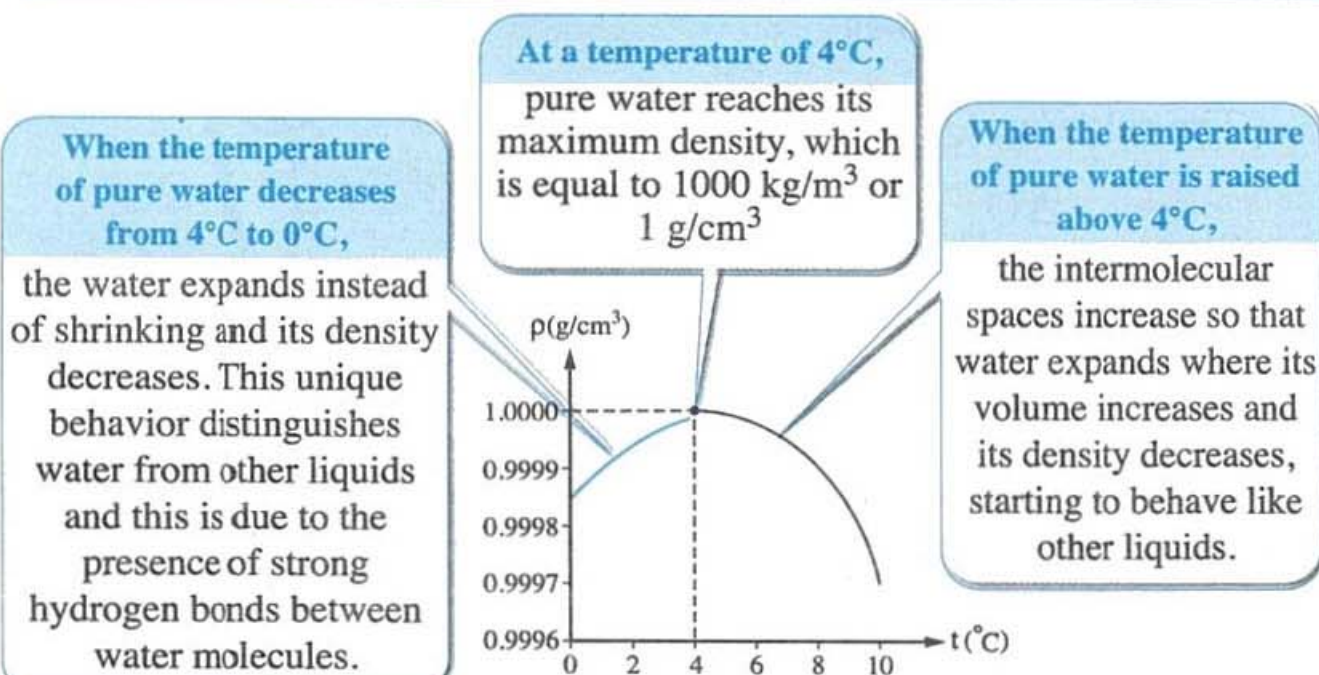
\* Slope =  $\frac{\Delta m}{\Delta V} = \rho$



**2 The relation between the volume [V] of an amount of pure water and the temperature in Celsius [t]**



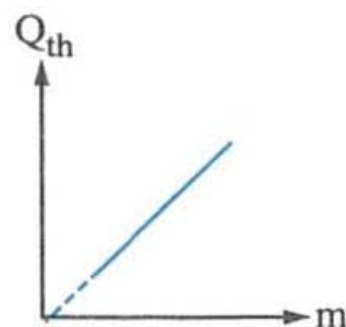
**3 The relation between the change in the density of pure water and the change in temperature**



**4 The relation between the amount of heat [ $Q_{th}$ ] gained or lost by a group of bodies of the same substance to cause the same change in temperature and the mass [m] of these bodies**

\* The relation:  $Q_{th} = mc\Delta t$

\* Slope =  $\frac{\Delta Q_{th}}{\Delta m} = c\Delta t$

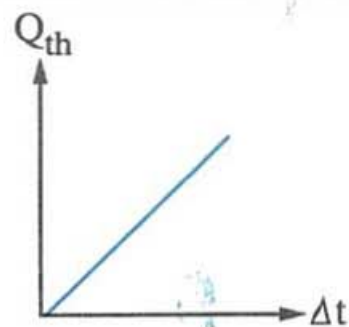




**5** The relation between the amount of heat [ $Q_{th}$ ] gained or lost by a body and the change required in the body temperature [ $\Delta t$ ]

\* The relation:  $Q_{th} = mc\Delta t$

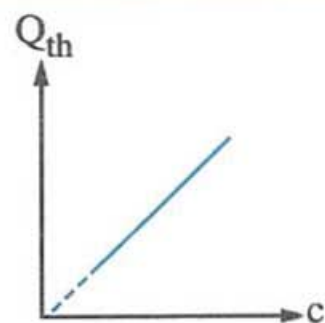
\* Slope =  $\frac{\Delta Q_{th}}{\Delta (\Delta t)} = mc$



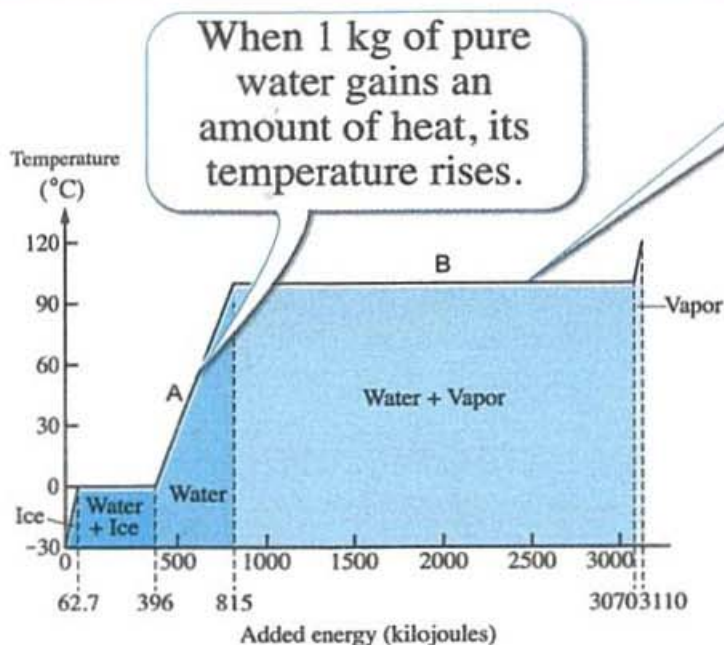
**6** The relation between the amount of heat [ $Q_{th}$ ] gained or lost by a group of bodies of the same mass of different substances when their temperature changes by the same value and the specific heat [ $c$ ] of these bodies

\* The relation:  $Q_{th} = mc\Delta t$

\* Slope =  $\frac{\Delta Q_{th}}{\Delta c} = m\Delta t$

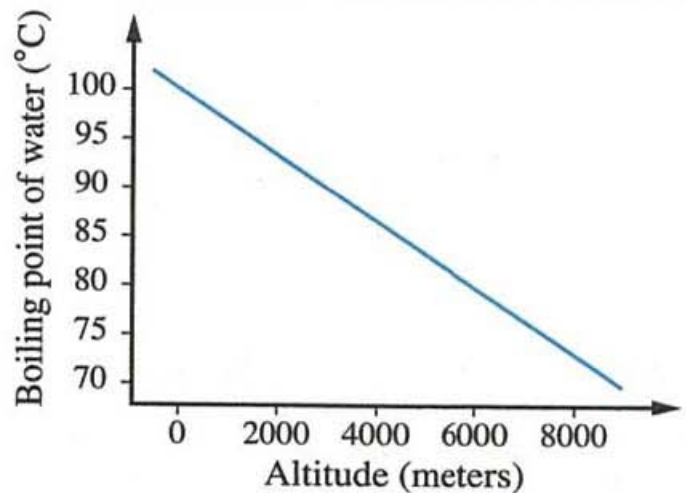


**7** The relation between the thermal energy gained or lost by 1 kg of water and the temperature of the water in Celsius

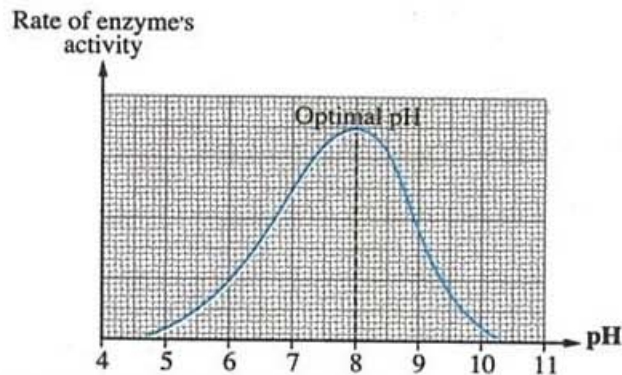


## 8 The relation between the boiling point of water and the altitude above sea level

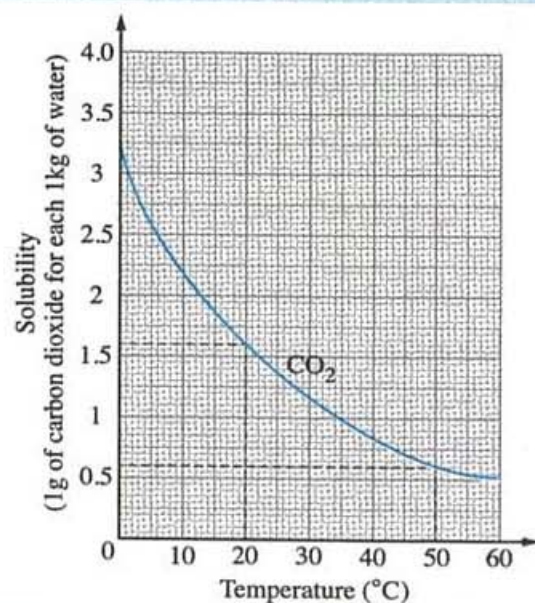
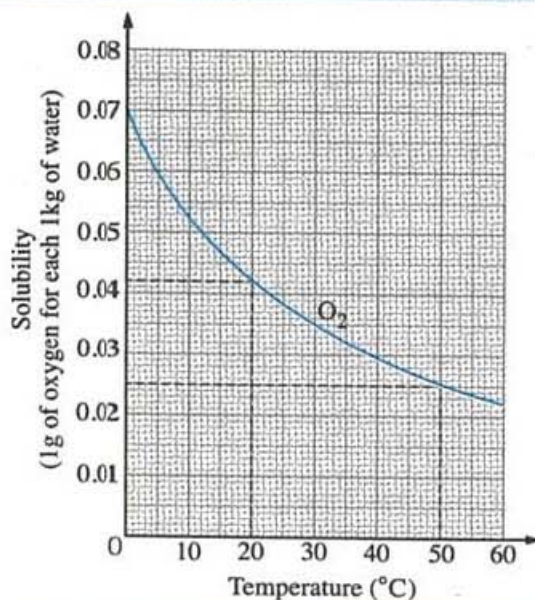
The boiling point of water **decreases** with rising above sea level due to **the decrease in atmospheric pressure**.



## 9 The effect of pH on the enzyme's activity



## 10 The relation between the solubility of $O_2$ and $CO_2$ in fresh water and temperature





|                                                                                                                                                                                                                  |                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| The spheres forming the natural environment.                                                                                                                                                                     | <b>4</b><br><b>(Hydrosphere, Atmosphere, Lithosphere &amp; Biosphere)</b> |
| The percentage of water that covers the Earth's surface.                                                                                                                                                         | <b>About 70%</b>                                                          |
| The percentage of land on the Earth's surface.                                                                                                                                                                   | <b>About 30%</b>                                                          |
| The percentage of salt water in oceans, seas and saltwater lakes regarding to the percentage of water that exists on the Earth's surface.                                                                        | <b>About 97%</b>                                                          |
| The percentage of fresh water in rivers, freshwater lakes, streams, reservoirs and groundwater (that can be used for human consumption) regarding to the percentage of water that exists on the Earth's surface. | <b>About 1%</b>                                                           |
| The percentage of frozen water in polar ice caps and glaciated rivers regarding to the percentage of water that exists on the Earth's surface.                                                                   | <b>About 2%</b>                                                           |
| The mass percentage of hydrogen in water molecule.                                                                                                                                                               | <b>11.11%</b>                                                             |
| The mass percentage of oxygen in water molecule.                                                                                                                                                                 | <b>88.89%</b>                                                             |
| The ratio between the hydrogen mass to the oxygen mass in water molecule.                                                                                                                                        | <b>1 : 8</b><br><b>Hydrogen : Oxygen</b>                                  |
| The angle between the two single covalent bonds in water molecule.                                                                                                                                               | <b>104.5°</b>                                                             |
| The maximum number of hydrogen bonds that a single water molecule can form with adjacent water molecules.                                                                                                        | <b>4</b>                                                                  |

|                                                                                                                                   |                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| The boiling point of pure water under normal atmospheric pressure.                                                                | <b>100°C</b>                                      |
| The boiling point of hydrogen sulphide under normal atmospheric pressure.                                                         | <b>- 61°C</b>                                     |
| The density of pure water at a temperature of 4°C.                                                                                | <b>1 g/cm<sup>3</sup></b>                         |
| The density of pure water at a temperature of 4°C in SI unit.                                                                     | <b>1000 kg/m<sup>3</sup></b>                      |
| The specific heat of pure water.                                                                                                  | <b>4200 J/kg.K</b>                                |
| Number of kingdoms of eukaryotes.                                                                                                 | <b>4</b>                                          |
| The percentage of water of the body mass in mammals.                                                                              | <b>About 70%</b>                                  |
| The percentage of water inside cells of the body mass in mammals.                                                                 | <b>About 47%</b>                                  |
| The percentage of water outside cells (in blood plasma and other body fluids) of the body mass in mammals.                        | <b>About 23%</b>                                  |
| The ratio between the concentration of oxygen gas and the concentration of carbon dioxide gas in atmospheric air.                 | <b>500 : 1<br/>O<sub>2</sub> : CO<sub>2</sub></b> |
| The ratio between the solubility of oxygen gas and the solubility of carbon dioxide gas in water.                                 | <b>1 : 50<br/>O<sub>2</sub> : CO<sub>2</sub></b>  |
| The solubility of oxygen and carbon dioxide gases in salt water in ocean compared to the solubility of both gases in fresh water. | <b>Less about<br/>20% - 30%</b>                   |
| The atmospheric pressure at sea level (standard atmospheric pressure).                                                            | <b>1.013 × 10<sup>5</sup> N/m<sup>2</sup></b>     |



## 5 Importance and uses

|                                        |                                                                                                                                                                                                                                                                  |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Xylem tissue</b>                    | It transports water and salts from the root to the upper parts of the plant.                                                                                                                                                                                     |
| <b>Hydrometer</b>                      | Measuring the relative density of liquids or their density in $\text{g/cm}^3$ .                                                                                                                                                                                  |
| <b>Peptidoglycan</b>                   | It gives the bacterial cell wall its shape and rigidity.                                                                                                                                                                                                         |
| <b>Cell wall</b>                       | It gives the cell its definite shape, encloses its components and protects them.                                                                                                                                                                                 |
| <b>Plasma membrane (Cell membrane)</b> | <ul style="list-style-type: none"> <li>* It protects the internal contents of the cell.</li> <li>* It regulates the passage of substances into and out of the cell.</li> </ul>                                                                                   |
| <b>Nucleus</b>                         | <ul style="list-style-type: none"> <li>* <b>It contains the genetic material that:</b> <ul style="list-style-type: none"> <li>- Determines the traits of the living organism.</li> <li>- Controls the activities of the cell.</li> </ul> </li> </ul>             |
| <b>Cytoplasm</b>                       | <ul style="list-style-type: none"> <li>* <b>A gel-like substance that contains:</b> <ul style="list-style-type: none"> <li>- Some important chemical substances for the cell's survival.</li> <li>- Organelles with many vital functions.</li> </ul> </li> </ul> |
| <b>Endoplasmic reticulum</b>           | It is used to transport various materials from one place to another inside the cell.                                                                                                                                                                             |
| <b>Mitochondria</b>                    | Centers of energy production in the cell.                                                                                                                                                                                                                        |
| <b>Vacuoles</b>                        | Store food, water and excess salts.                                                                                                                                                                                                                              |
| <b>Chloroplasts</b>                    | In which photosynthesis takes place, because they contain chlorophyll substance.                                                                                                                                                                                 |

|                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Water for the living organism</b></p>                 | <ul style="list-style-type: none"> <li>* It acts as a universal solvent, allowing biochemical reactions to occur by dissolving mineral salts and nutrients, carrying gases such as oxygen and carbon dioxide to facilitate their transport inside the living organism and getting rid of wastes out of it.</li> <li>* It represents the main component of cytoplasm, as the presence of water inside the cell:             <ul style="list-style-type: none"> <li>• Enables it to maintain its shape and structure.</li> <li>• Creates an internal pressure that resists the pressure surrounding the cell, which contributes to:                 <ul style="list-style-type: none"> <li>- The success of biochemical processes inside the cytoplasm.</li> <li>- Enabling the organelles to function properly.</li> </ul> </li> </ul> </li> <li>* It maintains the internal temperatures of living organisms stable despite its external fluctuations, due to the high specific heat of water.</li> <li>* It is the main factor in maintaining the internal balance of the body and supporting the complex chemical activities of life, as it directly participates in metabolic processes (metabolism).</li> </ul> |
| <p><b>Enzymes</b></p>                                       | <p>They increase the speed of chemical reactions in the cells of living organisms by reducing the activation energy required to start the reaction to lower levels.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <p><b>Oxygen gas in the aquatic environment</b></p>         | <p>Dissolved oxygen in water plays an important role in producing the energy necessary for marine organisms to carry out various biological processes by oxidizing glucose molecules (the main source of energy) during cellular respiration process, which is known as "catabolism" and it is one of the two metabolic processes.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <p><b>Carbon dioxide gas in the aquatic environment</b></p> | <p>CO<sub>2</sub> gas is considered a key element in photosynthesis process for the formation of organic substances, such as carbohydrates (like glucose), as shown by the following chemical equation:</p> $6\text{CO}_2 + 12\text{H}_2\text{O} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \underset{\text{Glucose}}{\text{C}_6\text{H}_{12}\text{O}_6} + 6\text{H}_2\text{O} + 6\text{O}_2 \uparrow$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |



|                                                                        |                                                                                                                                                                                                                                                           |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Air (Swim) bladder in salmon fish</b>                               | <ul style="list-style-type: none"> <li>* Transitioning between different depths during their migration between seas and rivers.</li> <li>* Controlling their buoyancy and balance in the water.</li> </ul>                                                |
| <b>Unsaturated fatty acids of cell membranes in deep-sea organisms</b> | They help them to maintain the fluidity and stability of cell membranes, which prevents the cell damage.                                                                                                                                                  |
| <b>Ecological balance in aquatic systems</b>                           | <ul style="list-style-type: none"> <li>* <b>It ensures the maintenance of:</b> <ul style="list-style-type: none"> <li>- Nutrients balance.</li> <li>- Balance among living organisms.</li> <li>- Energy flow through the food web.</li> </ul> </li> </ul> |

## 6 Laws and problems

**1** **Density ( $\rho$ ) =  $\frac{\text{Mass (m)}}{\text{Volume (V)}}$**

**Measuring unit**

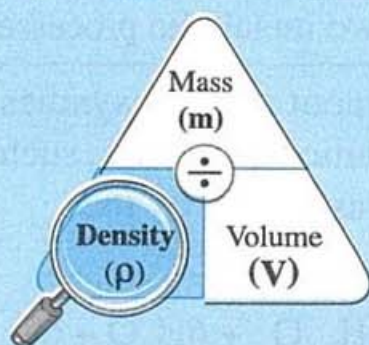
\* SI unit:  $\text{kg/m}^3$

\* Other units:  $\text{g/cm}^3$ ,  $\text{g/L}$

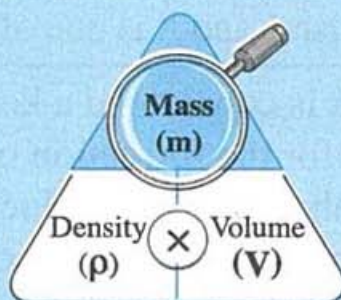
To convert between these units:

$$1 \text{ g/cm}^3 = 1000 \text{ kg/m}^3 = 1000 \text{ g/L}$$

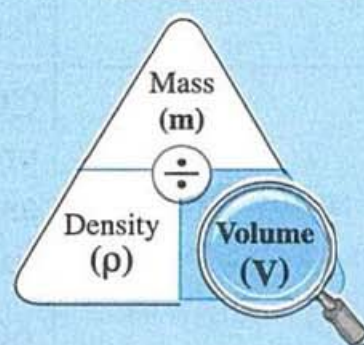
**To calculate density**



**To calculate mass**



**To calculate volume**



**Example** A tank contains a quantity of gasoline of mass 3450 kg and volume 5 m<sup>3</sup>, so **what** is the density of the gasoline?

**Solution**

$$m = 3450 \text{ kg}$$

$$V = 5 \text{ m}^3$$

$$\rho = ?$$

$$\rho = \frac{m}{V} = \frac{3450}{5} = 690 \text{ kg/m}^3$$

**Relative density of a substance**

**=**

**Density of the substance at a certain temperature**  
**Density of pure water at 4°C**

**2**

The value of the relative density of a substance equals the value of its density in g/cm<sup>3</sup>.

**Example**

If the density of aluminum and the density of pure water at 4°C are 2700 kg/m<sup>3</sup> and 10<sup>3</sup> kg/m<sup>3</sup> respectively, **calculate** the relative density of aluminum.

**Solution**

$$\rho_{\text{Al}} = 2700 \text{ kg/m}^3$$

$$\rho_{\text{w}} = 10^3 \text{ kg/m}^3$$

$$(\rho_{\text{Al}})_{\text{relative}} = ?$$

$$(\rho_{\text{Al}})_{\text{relative}} = \frac{\rho_{\text{Al}}}{\rho_{\text{w}}} = \frac{2700}{10^3} = 2.7$$

**3**

To convert between temperature on the Celsius scale ( $t_{\text{C}}$ ) and the Kelvin scale ( $T_{\text{K}}$ ), the opposite relation is used:

$$T_{\text{K}} = t_{\text{C}} + 273$$



**Example**

If you know that the normal human body temperature is  $37^{\circ}\text{C}$ , **what is** the equivalent temperature to it on the Kelvin scale?

**Solution**

$$\begin{aligned} T_K &= t_C + 273 \\ &= 37 + 273 = \mathbf{310\text{ K}} \end{aligned}$$

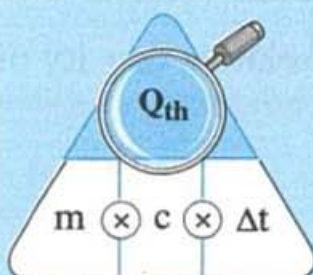
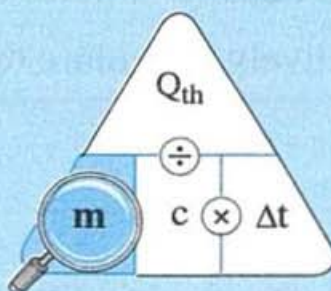
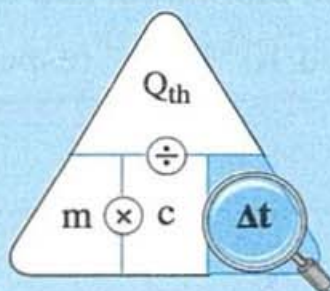
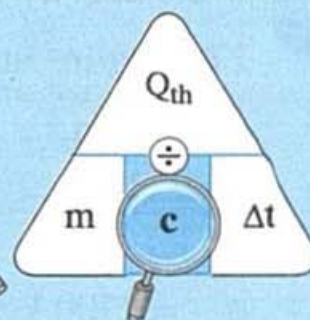
#### 4 Calculating the amount of heat gained or lost by a body:

The amount of heat ( $Q_{th}$ ) gained or lost by a body is determined using the opposite relation:

$$\begin{aligned} Q_{th} &= mc\Delta t \\ &= mc(t_2 - t_1) \end{aligned}$$

**Where:**

( $m$ ) is the mass of the body, ( $c$ ) is the specific heat of the substance of the body, ( $\Delta t$ ) is the change in temperature of the body, ( $t_1$ ) is the initial temperature of the body, ( $t_2$ ) is the final temperature of the body.

**To calculate ( $Q_{th}$ )****To calculate ( $m$ )****To calculate ( $\Delta t$ )****To calculate ( $c$ )****Example 1**

**Calculate** the amount of heat required to raise the temperature of 0.3 kg of copper from  $20^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

(Given that: the specific heat of copper =  $390\text{ J/kg.K}$ )

**Solution**

$$m = 0.3\text{ kg}$$

$$t_1 = 20^{\circ}\text{C}$$

$$t_2 = 70^{\circ}\text{C}$$

$$c = 390\text{ J/kg.K}$$

$$Q_{th} = ?$$

$$\begin{aligned} Q_{th} &= mc\Delta t = mc(t_2 - t_1) \\ &= 0.3 \times 390 \times (70 - 20) = \mathbf{5850\text{ J}} \end{aligned}$$

**Example 2**

A piece of aluminum of mass 200 g having a temperature of 80°C is dropped into a quantity of water at room temperature, so the final temperature of the system becomes 40°C. Knowing that the specific heat of aluminum is 900 J/kg.K, and assuming no thermal energy leaked or lost out from the system, **calculate** the amount of heat gained by the quantity of water.

**Solution**

$$m_{\text{Al}} = 200 \text{ g} = 200 \times 10^{-3} \text{ kg}$$

$$t_1 = 80^\circ\text{C}$$

$$t_2 = 40^\circ\text{C}$$

$$c_{\text{Al}} = 900 \text{ J/kg.K}$$

$$Q_{\text{th}} = ?$$

Based on the law of conservation of energy, the amount of heat gained by the water is equal to the amount of heat lost from the aluminum piece.

$$\begin{aligned} Q_{\text{th}} &= m_{\text{Al}} c_{\text{Al}} \Delta t = m_{\text{Al}} c_{\text{Al}} (t_2 - t_1) \\ &= 200 \times 10^{-3} \times 900 \times (40 - 80) = -7200 \text{ J} \end{aligned}$$

The negative sign here indicates that the aluminum piece has lost heat to be gained by the water sample, so the amount of heat transferred to the water is **7200 J**.

**Example 3**

Two vessels (1), (2) contain different amounts of water, vessel (1) contains 300 g of water at a temperature of 90°C, and vessel (2) contains 60 g of water at a temperature of 15°C. If the two amounts of water from the two vessels are mixed together, **calculate** the final temperature of the mixture ( $t_o$ ) neglecting the amounts of heat gained or lost by the vessels.

**Solution**

$$m_1 = 300 \text{ g}$$

$$\Delta t_1 = t_o - 90$$

$$m_2 = 60 \text{ g}$$

$$\Delta t_2 = t_o - 15$$

$$t_o = ?$$

∴ The total heat lost = - the total heat gained

$$\therefore m_1 c_1 \Delta t_1 = -m_2 c_2 \Delta t_2$$

∴ Both of the two vessels contain the same liquid (water) and the specific heat is constant for the same substance.

$$\therefore m_1 \Delta t_1 = -m_2 \Delta t_2, \quad 300 \times (t_o - 90) = -60 \times (t_o - 15)$$

$$\therefore t_o = 77.5^\circ\text{C}$$

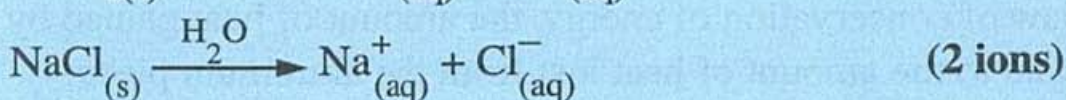
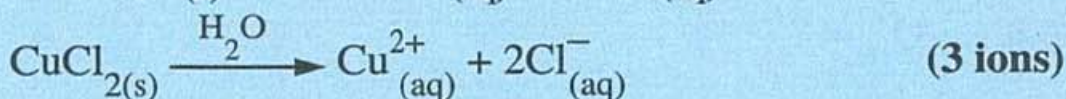
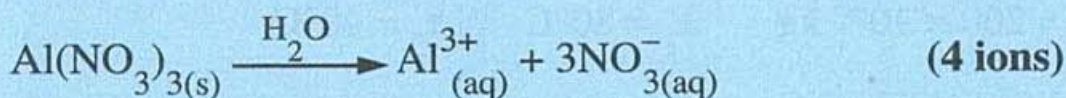


- 5 Assuming dissolving a known amount from each of  $\text{NaCl}$ ,  $\text{CuCl}_2$  and  $\text{Al}(\text{NO}_3)_3$  in equal amounts of water at the same temperature.

**Arrange the formed solutions ascendingly according to:**

- (1) Vapor pressure. (2) Boiling point.  
(3) Freezing point. (4) Osmotic pressure.

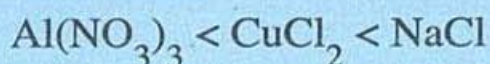
The number of the resulted ions from the dissolution of each molecule in water is calculated as follows:



### Solution

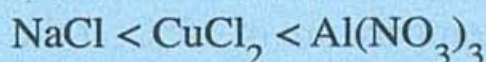
**(1) Vapor pressure:**

The vapor pressure decreases by increasing the number of solute ions or molecules. So, the arrangement will be:



**(2) Boiling point:**

The boiling point increases by increasing the number of solute ions or molecules. So, the arrangement will be:



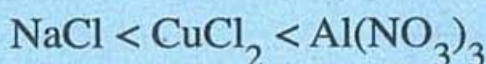
**(3) Freezing point:**

The freezing point decreases by increasing the number of solute ions or molecules. So, the arrangement will be:



**(4) Osmotic pressure:**

The osmotic pressure increases by increasing the number of solute ions or molecules. So, the arrangement will be:



### 6 Measuring the solubility of gas in the solution:

**Solubility**

**=**

$$\frac{\text{The mass of dissolved gas}}{\text{The volume of solution}}$$



Example

**Calculate** the solubility of  $O_2$  gas in water at a temperature of  $23^\circ C$ , when 16 mg of  $O_2$  has been dissolved and the solution has been completed till 2 L



**Solution**

$$\text{Solubility} = \frac{\text{The mass of dissolved gas}}{\text{The volume of solution}} = \frac{16}{2} = 8 \text{ mg/L}$$

## 7 Calculating the liquid pressure (P) at a point inside it:

\* The pressure of a liquid can be calculated by knowing the pressing force (F) resulted from the liquid pressure and affecting a surface of area (A) at that point from the relation:

$$P = \frac{F_g}{A}$$

\* SI measuring unit of force (F) is Newton (N).

Example

A cuboid fish tank of base area  $1000 \text{ cm}^2$  is placed on a horizontal surface and contains water of weight 4000 N, **what is** the water pressure on the bottom of the tank?



**Solution**

$$A = 1000 \text{ cm}^2 = 1000 \times 10^{-4} \text{ m}^2$$

$$F_g = 4000 \text{ N}$$

$$P = ?$$

$$P = \frac{F_g}{A} = \frac{4000}{1000 \times 10^{-4}} = 4 \times 10^4 \text{ N/m}^2$$

## 7 What are the factors

### 1 On which the density of a pure substance depends?

- (1) The mass of molecules.
- (2) The spaces between molecules.



**2 That affect the density of water in the oceans?**

- (1) Water pressure "has an effect at great depths".
  - (2) Water temperature.
  - (3) Water salinity.
- 

**3 On which the amount of heat gained or lost by a body depends?**

- (1) Mass of the body (m).
  - (2) Specific heat of the body substance (c).
  - (3) The change required in the body temperature ( $\Delta t$ ).
- 

**4 On which the specific heat of a substance depends?**

- (1) The type of substance.
  - (2) The physical state of the substance.
  - (3) The degree of purity of the substance.
- 

**5 That affect the enzyme's activity?**

- (1) Temperature.
  - (2) pH of the reaction medium.
- 

**6 That affect aquatic environments and the living organisms in them?**

- (1) The effect of atmospheric air gases dissolving in water.
  - (2) The penetration of light and solar radiation through water.
  - (3) The effect of pressure inside water.
- 

**7 That affect the solubility rate of oxygen and carbon dioxide gases in water?**

- (1) Temperature.
- (2) Pressure.
- (3) The nature of materials.

## 8 Tables and comparisons

| 1                                                 | Water (H <sub>2</sub> O)     | Hydrogen sulphide (H <sub>2</sub> S) |
|---------------------------------------------------|------------------------------|--------------------------------------|
| Chemical structure                                |                              |                                      |
| Type of bonds between the atoms in the molecule   | Covalent                     | Covalent                             |
| Hydrogen bonds between molecules                  | Present                      | Absent                               |
| Boiling point (under normal atmospheric pressure) | High (100°C)                 | Low (− 61°C)                         |
| Molecule polarity                                 | Higher than H <sub>2</sub> S | Lower than H <sub>2</sub> O          |
| Molecular mass                                    | Less than H <sub>2</sub> S   | Greater than H <sub>2</sub> O        |

| 2                                                                            | Basic solution                                                                                                                                                                                                                               | Neutral solution                                                                                                                                                                                                                                        | Acidic solution                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The relation between the concentration of H <sup>+</sup> and OH <sup>−</sup> | H <sup>+</sup> < OH <sup>−</sup>                                                                                                                                                                                                             | H <sup>+</sup> = OH <sup>−</sup>                                                                                                                                                                                                                        | H <sup>+</sup> > OH <sup>−</sup>                                                                                                                                                                                                                 |
| The pH value of the solution                                                 | Greater than 7                                                                                                                                                                                                                               | Equals 7                                                                                                                                                                                                                                                | Less than 7                                                                                                                                                                                                                                      |
| Example                                                                      | <p>The solution resulted from the dissolution of sodium bicarbonate (NaHCO<sub>3</sub>) salt in water</p> $\text{NaHCO}_{3(s)} + \text{H}_2\text{O}_{(l)} \rightarrow \text{Na}^+_{(aq)} + \text{OH}^-_{(aq)} + \text{H}_2\text{CO}_{3(aq)}$ | <p>The solution resulted from the dissolution of ammonium bicarbonate (NH<sub>4</sub>HCO<sub>3</sub>) salt in water</p> $\text{NH}_4\text{HCO}_{3(s)} + \text{H}_2\text{O}_{(l)} \rightarrow \text{H}_2\text{CO}_{3(aq)} + \text{NH}_4\text{OH}_{(aq)}$ | <p>The solution resulted from the dissolution of ammonium chloride (NH<sub>4</sub>Cl) salt in water</p> $\text{NH}_4\text{Cl}_{(s)} + \text{H}_2\text{O}_{(l)} \rightarrow \text{NH}_4\text{OH}_{(aq)} + \text{H}^+_{(aq)} + \text{Cl}^-_{(aq)}$ |



| 3                                              | The pH meter                                                                           | The pH test paper tapes (strips)                                                              |
|------------------------------------------------|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| <b>Observation during using or measurement</b> | On immersing the electrode of the device in the solution, digital reading is appeared. | On immersing the strip in the solution, it has been colored by a certain color.               |
| <b>Determination of the pH value</b>           | The value ranges from 0 to 14, on which pH value is determined.                        | The color is compared with the attached standard chart with strips to determine the pH value. |

| 4                                            | Warm-blooded organisms                                                                                                                                   | Cold-blooded organisms                                                                                                                                                                  |
|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Method of regulating body temperature</b> | Organisms that can maintain a constant internal body temperature through metabolic processes, regardless the temperature of the surrounding environment. | Organisms that rely on external sources (like the sunlight or warm environments) to regulate their body temperature, which changes with the temperature of the surrounding environment. |
| <b>Examples</b>                              | <ul style="list-style-type: none"> <li>* Birds.</li> <li>* Mammals.</li> </ul>                                                                           | <ul style="list-style-type: none"> <li>* Most vertebrates like fish, amphibians and reptiles.</li> <li>* All invertebrates like arthropods and mollusks.</li> </ul>                     |

| 5                                        | Pure water                                                                            | Aqueous solution                                                                                                                                                                                                                     |
|------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Forces that affect the properties</b> | Attraction forces among water molecules that are produced from hydrogen bonds (weak). | <ul style="list-style-type: none"> <li>* Attraction forces between water molecules that is produced from hydrogen bonds (weak).</li> <li>* Attraction forces among water molecules and solute molecules or ions (strong).</li> </ul> |
| <b>The value of vapor pressure</b>       | Higher                                                                                | Lower                                                                                                                                                                                                                                |
| <b>Boiling point</b>                     | Lower                                                                                 | Higher                                                                                                                                                                                                                               |
| <b>Freezing point</b>                    | Higher                                                                                | Lower                                                                                                                                                                                                                                |
| <b>Osmotic pressure</b>                  | Vanished (due to the absence of solutes).                                             | Has a value that increases by increasing the number of solute molecules or ions.                                                                                                                                                     |

| 6                                                  | Prokaryotes                                             | Eukaryotes                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Number of cells forming the living organism</b> | Unicellular                                             | Unicellular or multicellular                                                                                                                                                                                                                                                                                    |
| <b>Site of genetic material</b>                    | In the cytoplasm, not surrounded by a nuclear membrane. | Inside the nucleus and surrounded by a nuclear membrane.                                                                                                                                                                                                                                                        |
| <b>Examples</b>                                    | Bacteria                                                | <ul style="list-style-type: none"> <li>* <b>Eukaryotes are classified into four kingdoms:</b> <ul style="list-style-type: none"> <li>- Kingdom Protista, like golden algae.</li> <li>- Kingdom Fungi, like yeast.</li> <li>- Kingdom Plantae.</li> <li>- Kingdom Animalia, like sponges.</li> </ul> </li> </ul> |



| 7                                                  | Kingdom Protista                                                                  | Kingdom Fungi                                                             | Kingdom Plantae                 | Kingdom Animalia               |
|----------------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------|--------------------------------|
| <b>Number of cells forming the living organism</b> | Most of them are unicellular and some of them are simple multicellular organisms. | Most of them are multicellular and some of them are unicellular as yeast. | Most of them are multicellular. | All of them are multicellular. |
| <b>Mode of nutrition</b>                           | * Can be:<br>- Autotrophic as golden algae.<br>- Heterotrophic as protozoa.       | Heterotrophic                                                             | Autotrophic                     | Heterotrophic                  |
| <b>Cell wall structure</b>                         |  | Chitin substance.                                                         | Cellulose substance.            | There is no cell wall.         |

| 8 | Invertebrates                                                                                                                                                                                                                                                                            | Vertebrates                                                                                                                                                                                    |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | They have no backbone                                                                                                                                                                                                                                                                    | They have backbone                                                                                                                                                                             |
|   | <b>* They include:</b> <ul style="list-style-type: none"> <li>- Sponges, such as sponge.</li> <li>- Coelenterates, such as jellyfish.</li> <li>- Worms.</li> <li>- Arthropods, such as insects.</li> <li>- Mollusks, such as clams.</li> <li>- Echinoderms, such as starfish.</li> </ul> | <b>* They include:</b> <ul style="list-style-type: none"> <li>- Fish.</li> <li>- Amphibians.</li> <li>- Reptiles.</li> <li>- Birds.</li> <li>- Mammals, including human at the top.</li> </ul> |

| 9                  | Cell wall                                     | Plasma membrane (Cell membrane)                                                                                         |
|--------------------|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | A thick wall surrounds the cell from outside. | A thin semi-permeable membrane surrounds the cell and separates between its components and its surrounding environment. |
| <b>Location</b>    | Plant cells, fungi and bacteria.              | In all living cells.                                                                                                    |

| 10     | Vacuoles in plant cell                                           |  | Vacuoles in animal cell |  |
|--------|------------------------------------------------------------------|--|-------------------------|--|
| Size   | Large                                                            |  | Small                   |  |
| Number | One, located at the center of the cell and called "sap vacuole". |  | Numerous                |  |

| 11         | Catabolism                                                                                                                  |  | Anabolism                                                                                      |  |
|------------|-----------------------------------------------------------------------------------------------------------------------------|--|------------------------------------------------------------------------------------------------|--|
| Definition | A process of breaking the chemical bonds among the atoms of complex molecules to release the energy that is stored in them. |  | A process of building large and complex molecules from simple molecules with consuming energy. |  |
| Examples   | The breakdown of glucose during cellular respiration process into $\text{CO}_2$ and water.                                  |  | * Synthesis of proteins from amino acids.<br>* Photosynthesis process.                         |  |

| 12                                  | Example                                               | Structural suitability or existed structures                  | Purpose                                                                     |
|-------------------------------------|-------------------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------------------------|
| Structural (Anatomical) adaptations | ①<br>Bony fish in general (for example: tilapia fish) | Streamlined body.                                             | Reducing the water resistance to the fish movement.                         |
|                                     |                                                       | Scales and mucus.                                             | To be water-resistant and reduce the water resistance to the fish movement. |
|                                     |                                                       | Fins                                                          | Organs of locomotion in water.                                              |
|                                     |                                                       | Air (Swim) bladder.                                           | For floating in water.                                                      |
|                                     |                                                       | Gills                                                         | The extraction of dissolved oxygen in water.                                |
|                                     | ②<br>Deep-sea fish (such as icefish)                  | Large eyes                                                    | To enable them to see in the dark.                                          |
|                                     |                                                       | Compressed body.                                              | Withstanding the high pressure of water.                                    |
|                                     | ③<br>Dolphins (from mammals)                          | Streamlined body.                                             | Reducing the water resistance to the fish movement.                         |
|                                     |                                                       | Fins instead of legs.                                         | Helping them to swim.                                                       |
|                                     |                                                       | Breathing openings at the top of their heads instead of nose. | Allowing them to breathe the atmospheric air.                               |



| 13                     | Example          | Behavior                                      | Purpose                             |
|------------------------|------------------|-----------------------------------------------|-------------------------------------|
| Behavioral adaptations | ①<br>Salmon fish | Migration between fresh water and salt water. | Reproduction and survival.          |
|                        | ②<br>Whales      | Producing sounds.                             | Communication and hunting of preys. |

| 14                        | Conditions             | Example                               | Physiological suitability                                                                                                                                                                                                                        |
|---------------------------|------------------------|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Physiological adaptations | Lack of oxygen.        | Some fish in deep oceans.             | They reduce their oxygen needs by slowing down their metabolic rate.                                                                                                                                                                             |
|                           | High water pressure.   | Some fish at depths.                  | <ul style="list-style-type: none"> <li>* They withstand high pressure through strong and durable arteries and veins.</li> <li>* They effectively adjust their blood pressure to be proportional to the high pressure exerted on them.</li> </ul> |
|                           | Low osmotic pressure.  | Unicellular organisms in fresh water. | They collect excess water from the cell in the contractile vacuole, which is pushed towards the cell membrane to discharge the water from it.                                                                                                    |
|                           |                        | Freshwater fish.                      | They get rid of excess water passing into the body through the kidneys in the form of diluted urine.                                                                                                                                             |
|                           | High osmotic pressure. | Most saltwater fish.                  | They swallow large amounts of water and then get rid of excess salts through the kidneys and specialized cells in the gills.                                                                                                                     |
|                           |                        | Sharks                                | They retain a high concentration of urea (a nitrogenous compound produced in the urine of many animals) to bring the osmotic pressure in their blood close to the osmotic pressure of the surrounding water.                                     |

| 15                                                | Osmoregulation of freshwater fish              | Osmoregulation of most saltwater fish         |
|---------------------------------------------------|------------------------------------------------|-----------------------------------------------|
| Osmotic pressure of fluids in the organisms' body | More than the osmotic pressure of fresh water. | Less than the osmotic pressure of salt water. |
| The organ which is responsible for adaptation     | Two kidneys.                                   | Kidneys and specialized cells in gills.       |
| The form of excreted water                        | Diluted urine.                                 | Concentrated urine.                           |

| 16                                                   | Oxygen gas                                                                                                                                                                                                                                                                                                       | Carbon dioxide gas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The sources in the aquatic environment               | <ul style="list-style-type: none"> <li>* The atmospheric air "the main source".</li> <li>* Phytoplankton, algae and aquatic plants through photosynthesis process.</li> </ul>                                                                                                                                    | <ul style="list-style-type: none"> <li>* The atmospheric air.</li> <li>* Marine organisms through respiration process.</li> <li>* Human activities, such as industrial pollution and decomposition of organic matter carried by agricultural wastewater.</li> </ul>                                                                                                                                                                                                                                                                                  |
| The effect of increasing the gas percentage in water | <ul style="list-style-type: none"> <li>* Supporting respiration.</li> <li>* Improving metabolism.</li> <li>* Increasing the activity of swimming, hunting and reproduction.</li> <li>* Maintaining the balance of ecosystem through supporting diverse populations of plants, invertebrates and fish.</li> </ul> | <p><b>* It has several negative effects on the aquatic organisms, including:</b></p> <ul style="list-style-type: none"> <li>- The acidification which is harmful to egg and larval stages of some aquatic organisms.</li> <li>- Impairing respiration.</li> <li>- Weakening support structure: The increase of CO<sub>2</sub> in water leads to reducing calcification, which obstructs the ability of some organisms to build or maintain their skeletons and affects calcium balance in the bodies of fish, which weakens their growth.</li> </ul> |



| 17                 | External support in aquatic organisms                                                                                                                                                          | Internal support in aquatic organisms                                                                                                                                                                                                  |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | It is the external skeleton of living organisms.                                                                                                                                               | It is the internal skeleton of living organisms.                                                                                                                                                                                       |
| <b>Formation</b>   | <ul style="list-style-type: none"> <li>* Chitin in some crustaceans, such as shrimps.</li> <li>* Calcium carbonate such as in oysters (from mollusks) and corals (from cnidarians).</li> </ul> | <ul style="list-style-type: none"> <li>* Bony skeleton: Consists primarily of calcium phosphate in addition to the collagen protein, such as in tilapia.</li> <li>* Cartilaginous skeleton: Such as in sharks and ray fish.</li> </ul> |

| 18 The photic zones in water                                                 |                                                                                         |                                                                 |
|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| The sunlit (surface) zone                                                    | The twilight (mid-depth) zone                                                           | The dark (deep) zone                                            |
| A zone in which sufficient light is available for supporting photosynthesis. | A zone that receives a lower amount of light, which is insufficient for photosynthesis. | A zone where no light reaches, therefore it is completely dark. |

| 19                                  | Surface organisms                                                                        | Intermediate-depth organisms                                                                                                                   | Deep-sea organisms                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>The depth where they live</b>    | Live near the water surface.                                                             | Live at intermediate depths from 200 m to 1000 m.                                                                                              | Live at depths greater than 2000 m.                                                                                                                                                                                                                                                                                                                         |
| <b>Means of adaptation to depth</b> | Having body structure that is less strong compared to organisms that live in the depths. | Use their swim (air) bladder to control their buoyancy and balance or to move between different depths during migration among seas and rivers. | <ul style="list-style-type: none"> <li>* Have compact body structures.</li> <li>* Their bodies contain protein components and internal fluids.</li> <li>* Their bladders contain fluids instead of gases.</li> <li>* Having a large, oil-rich liver.</li> <li>* Having high levels of unsaturated fatty acids in their cell membranes structure.</li> </ul> |
| <b>Example</b>                      | Sardine                                                                                  | Salmon                                                                                                                                         | Ray fish                                                                                                                                                                                                                                                                                                                                                    |

| 20                                  | Bony fish (Osteichthyes)                                                                                                                       | Cartilaginous fish (Chondrichthyes)                                                  |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| <b>The type of skeleton</b>         | Bony                                                                                                                                           | Cartilaginous                                                                        |
| <b>Flexibility</b>                  | Less flexible                                                                                                                                  | More flexible                                                                        |
| <b>Suitability with environment</b> | Strong bones help in supporting and keeping the stability of the body under different pressures, such as the water movement or water pressure. | Light, flexible cartilages that help in dealing with high pressures.                 |
| <b>Examples</b>                     | <ul style="list-style-type: none"> <li>* Tilapia fish.</li> <li>* Mullet fish.</li> </ul>                                                      | <ul style="list-style-type: none"> <li>* Shark fish.</li> <li>* Ray fish.</li> </ul> |



**1) From the properties of pure water:**

- (1) It is a polar compound.
  - (2) It is a universal solvent for most substances, due to its ability to dissolve many ionic compounds, polar covalent compounds, and compounds with polar molecules.
  - (3) It is neutral (its pH value = 7).
  - (4) It forms acidic, basic or neutral solutions with salts, depending on the type of salt.
  - (5) It can exist in the three states of matter (solid – liquid – gas) within the known temperature range on the Earth's surface.
  - (6) Its atoms are bound by single covalent bonds, while its molecules are bound by hydrogen bonds.
  - (7) It boils at 100°C.
  - (8) Its density decreases when its temperature is lowered from 4°C to 0°C.
  - (9) It has a high specific heat.
  - (10) It has a high latent heat of vaporization.
- 

**2) The working principle of a hydrometer is based on the law of buoyancy since when the hydrometer is placed in a liquid, it is partially submerged according to the liquid's density **where in liquids with:****

- \* **High density:** A smaller part of the hydrometer is submerged.
  - \* **Low density:** A larger part of the hydrometer is submerged.
- 

**3) Ocean currents transport with the water from one region to another:**

- \* **Heat and salt** from the equatorial regions to the Earth's poles.
- \* **Nutrients** from the ocean depths to the surface.

\* **Fresh water** from rivers or molten glaciers to different places during their journey around the Earth.

4 The Kelvin scale is a scale for determining temperature in the International System of Units.

5 Celsius scale has negative values, since the zero Celsius is an arbitrary point, while Kelvin scale doesn't contain negative values, as the zero Kelvin represents the absolute zero temperature which is the temperature at which the kinetic energies of the system molecules cease (become zero).

6 When the temperature changes by one degree on the Celsius scale, it also changes by one unit on the Kelvin scale, i.e. **it is always:**

$$\Delta t (^{\circ}\text{C}) = \Delta t (\text{K})$$

7 When expressing the amount of heat transferred from or to a body, **its sign will be:**

\* **Positive:** when it is gained by the body.

\* **Negative:** when it is lost by the body.

8 Most living cells contain a nucleus having a genetic material, so they belong to the eukaryotes.

9 The kingdom Protista whose individuals are often aquatic.

10 The cells of living organisms are composed of organic molecules such as carbohydrates, proteins and lipids and inorganic molecules such as mineral salts and water.

11 **Action mechanism of enzyme:**

The action mechanism of enzymes is based on the lock-key theory, where the substrate shape fits exactly the enzyme through what is



known as "active site". The active site of the enzyme binds to the substance that is affected by, which is called the "substrate", helping to convert it into products with highly efficiency without any change occurring to the enzyme, so that it is ready to catalyze another reaction of the same type.

---

## 12 Properties of enzymes:

- (1) They participate in chemical reactions in the cell to increase their speed without being affected or changed.
  - (2) They are specific, so each enzyme is specific to one reactant called the "substrate".
  - (3) They reduce the activation energy required to start the reaction.
  - (4) They are affected in their action by the pH value and temperature.
- 

13 Viperfish, which lives in the tropical regions of the major oceans, is one of the famous examples of structural and physiological adaptations of deep-ocean fish, **as it:**

- \* Is characterized by the flexibility of its skeleton to withstand high pressure.
  - \* Has high levels of hemoglobin in its blood to adapt with decreasing oxygen levels.
- 

14 The decrease in the percentage of dissolved  $\text{CO}_2$  gas in water on aquatic organisms, **leads to:**

- (1) Reducing the efficiency rate of photosynthesis and energy production.
- (3) Impacting food chains.
- (3) Disrupting water pH balance.

- 15 The amount of reflected energy from water surface depends on the angle at which sun rays hit the water surface, **so if the sun rays hit the water surface:**
- \* **Perpendicularly:** a small part of sunlight gets reflected.
  - \* **Inclined (at an angle):** a large part of sunlight gets reflected.
- 
- 16 During the propagation of solar radiation in the sunlit (surface) zone, **we find that:**
- (1) Infrared rays are absorbed almost completely within 10 cm of depth from the surface.
  - (2) Visible light, **at a depth of:**
    - \* **10 m:** more than 50% of its energy that was incident on the surface is absorbed.
    - \* **100 m:** about 99% of its energy that was incident on the surface in clear equatorial waters is absorbed, letting only about 1%, mostly in the blue spectrum.
- 
- 17 As light penetrates ocean water, longer wavelengths (warm colors like red and orange) are absorbed, while shorter wavelengths (cool colors like blue and violet) are scattered.
- 
- 18 Tropical aquatic fish such as tuna and barracuda fish live in warm water, while cod fish prefers cold water that is present in regions further from the equator.
- 
- 19 Gases are characterized by their ability to be compressed and to occupy any space, whereas liquids resist compression and thus maintain a nearly constant volume.
- 
- 20 The pressure increases by about 1 atm per each 10 meters of depth beneath the water surface, while it is equal to the atmospheric pressure at the sea surface.



## 21) **The pressure at a point inside water increases with increasing:**

- (1) **The depth (h):** as the depth from the surface increases, the pressure increases due to the increased weight of the water column acting on a unit area at that point.
- (2) **Water density ( $\rho$ ):** where the pressure at a certain depth in seawater is greater than the pressure at the same depth in lake water (fresh water, which has a low concentration of salts and low plankton population).

## 22) **The impact of human activities on the aquatic life:**

### \* **First: Negative activities that cause the ecological imbalance:**

- (1) **Pollution of water bodies with chemical substances:** such as pesticides and heavy metals that can affect water quality and harm the health of living organisms.
- (2) **Overfishing:** can lead to a decrease in the numbers of some species and affect the ecological balance.
- (3) **Habitat destruction:** destruction of natural habitats, such as coral reefs and wetlands, causes a loss of biodiversity.

### \* **Second: Positive activities that maintain the ecological balance:**

- (1) Preservation of natural resources.
- (2) Environmental awareness and education.
- (3) Sustainable development.
- (4) Adopting the eco-friendly practices.

## 10 **Reasons and explanations**

### 1) **The living organisms interact with each other and with the non-living components in the ecosystem.**

To adapt to the changeable conditions in the ecosystem.

**2 Ocean water is not suitable for direct use.**

Because of its high salt content.

---

**3 Condensation has an important role in the water cycle in nature.**

Because condensation contributes to the formation of clouds.

---

**4 Stomata are important for the adaptation of plants to high atmospheric temperatures.**

Because the plant gets rid of excess water in the form of vapor through the stomata during the process of transpiration, which lowers the temperature of the plant.

---

**5 Water has an important role inside the living organism's cells.**

As all the living organism's cells are surrounded by a membrane that allows the passage of water from the environment to inside the living cell carrying the required substances for producing energy and allows the passage of water from inside the cell to outside in order to get rid of wastes.

---

**6 Water is a polar compound.**

As the oxygen atom is characterized by being more electronegative than hydrogen atom. So, the electrons of the covalent bond are polarized (attracted) towards the oxygen atom forming a partial negative charge on the oxygen atom and a partial positive charge on the hydrogen atom.

---

**7 \* The elevation of the boiling point of pure water, although it is a covalent compound.**

**\* Water is liquid while hydrogen sulphide is gas, despite their similarity in structure.**

Due to the presence of hydrogen bonds among the water molecules, which causes its presence in the liquid state and having



high boiling point (while hydrogen bonds are absent among hydrogen sulphide molecules which causes its presence in the gaseous state).

---

**8 The dissolution of sodium chloride in water is not considered hydrolysis.**

Because the ions resulting from the dissociation of the salt do not react with water to form new acids or bases, but rather the salt ions remain in the solution without binding to the water ions.

---

**9 \* Pure water is neutral.**

**\* Water is at an ionic equilibrium.**

As some of its molecules dissociate to form hydrogen ( $\text{H}^+$ ) ions, causing acidity, and hydroxide ( $\text{OH}^-$ ) ions causing basicity in equal concentrations.

---

**10 The solution that is produced from the dissolution of ammonium bicarbonate salt in water is neutral.**

Because when ammonium bicarbonate ( $\text{NH}_4\text{HCO}_3$ ) salt dissolves in water, hydrolysis occurs and the concentration of hydrogen ( $\text{H}^+$ ) ions remains equal to the concentration of hydroxide ( $\text{OH}^-$ ) ions, which makes the solution neutral.

---

**11 The solution that is produced from the dissolution of sodium bicarbonate salt in water is alkaline.**

Because when sodium bicarbonate ( $\text{NaHCO}_3$ ) salt dissolves in water, hydrolysis occurs and this causes a decrease in the concentration of hydrogen ( $\text{H}^+$ ) ions and an increase in the concentration of hydroxide ( $\text{OH}^-$ ) ions, which makes the solution alkaline.

- 12 The solution that is produced from the dissolution of ammonium chloride salt in water is acidic.**

Because when ammonium chloride ( $\text{NH}_4\text{Cl}$ ) salt dissolves in water, hydrolysis occurs and this causes an increase in the concentration of hydrogen ( $\text{H}^+$ ) ions and a decrease in the concentration of hydroxide ( $\text{OH}^-$ ) ions, which makes the solution acidic.

- 13 The density of a pure liquid substance does not change by changing the mass or the volume of a sample taken from it at a specific temperature.**

Because the density of a pure liquid substance is a characteristic physical property, so that the ratio between the mass of any sample of the substance and its volume is a constant value equal to its density.

- 14 Density has a unit of measurement, while relative density does not.**

Because density is calculated by dividing two different quantities (mass and volume), whereas relative density is a ratio of two similar quantities (e.g., density of a substance and density of water), so the units cancel out.

- 15 The presence of mercury in the bulb of a hydrometer.**

Because it helps the device balance vertically in liquids.

- 16 Lake water in polar regions begins to freeze at the surface rather than the bottom.**

\* Because as surface water cools from  $4^\circ\text{C}$  to  $0^\circ\text{C}$ , it expands and becomes less dense than the water below it. This cold layer floats on top of the warmer denser water.

\* As the temperature continues to decrease, this surface layer freezes, and the resulting ice floats, since it is even less dense than the water beneath it.



**17) Fish can survive in frozen lakes and rivers.**

Because the surface layer of ice acts as a thermal insulator for the water below, allowing it to remain liquid at approximately  $4^{\circ}\text{C}$  near the bottom.

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**18) When water from melting ice enters the ocean, it floats on the surface instead of sinking.**

Because the density of melting ice (fresh water) is lower than that of ocean water (salt water).

---

**19) Water has a high specific heat compared to other liquids.**

This is due to the strong hydrogen bonds between its molecules, which require a large amount of energy to break.

---

**20) Water is used as a cooling agent in car engines and factories.**

Its high specific heat allows it to absorb a large amount of heat with only a relatively small increase in its own temperature.

---

**21) Large water bodies help to moderate the temperature of surrounding areas.**

**Because in the summer:**

- \* **During the day:** The Sun heats the land faster than the water. As cool air from over the water moves towards the land to replace the rising hot air (creating a sea breeze).
  - \* **During the night:** The water slowly releases its stored heat into the atmosphere, which prevents temperatures from dropping sharply and helps maintain temperature stability.
- 

**22) Water has a high latent heat of vaporization.**

This is due to the presence of hydrogen bonds between its molecules, that require a large amount of thermal energy to break.

---

**23) The importance of water's high latent heat of vaporization for living organisms.**

It helps living organisms regulate their body temperature, as

evaporating water molecules carry heat away from the body during the process of **sweating** or **transpiration**.

---

**24 The vapor pressure of solution is always lower than the vapor pressure of the pure solvent forming it.**

As the number of molecules exposed to evaporation from the surface of the solution is less, because some solute molecules or ions occupy a part of the liquid surface, as the energy required to overcome the strong attraction forces between water molecules and solute molecules or ions increases, therefore the number of evaporable molecules decreases and the vapor pressure of the solution decreases.

---

**25 The boiling point of aqueous solution is higher than the boiling point of pure water at standard atmospheric pressure.**

Due to the decrease in the vapor pressure of the solution compared to the vapor pressure of pure water. As the presence of attraction forces between the solute molecules or ions and the solvent (water), which leads to increasing the required energy to evaporate the liquid.

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**26 Spreading large amounts of salt on roads in cold countries at rainfall.**

To prevent the freezing of rainwater on roads, prevent cars from skidding and reduce accidents.

---

**27 The freezing point of an aqueous solution is always lower than the freezing point of pure water.**

Because the attraction forces between water molecules and solute molecules or ions prevent the binding of water molecules with each other to form ice crystals.



**28) Bacteria belong to prokaryotes.**

Because they are living organisms whose cytoplasm contains genetic material that is not surrounded by a nuclear membrane.

---

**29) Protozoa belong to eukaryotes.**

Because they are living organisms whose cytoplasm contains genetic material surrounded by a nuclear membrane.

---

**30) The cell wall of bacteria is characterized by containing peptidoglycan.**

To give it the shape and rigidity.

---

**31) \* The nucleus determines the traits of the living organism.**

**\* The nucleus controls the activities of the living cell.**

Because the nucleus contains the genetic material.

---

**32) The cytoplasm has an important role in the survival of the cell.**

Because the cytoplasm contains some important chemical substances for the survival of the cell.

---

**33) Chloroplasts have an important role in carrying out photosynthesis.**

Because they contain chlorophyll substance.

---

**34) Water acts as a universal solvent in the living cell.**

Because it allows biochemical reactions to occur by dissolving mineral salts and nutrients, carrying gases like oxygen and carbon dioxide to facilitate their transport inside the living organism and getting rid of wastes from the living organism.

---

**35) The internal temperature of living organisms is stable, despite the external fluctuations.**

This is due to the high specific heat of water.

- 36) \* **Water has a role in maintaining the internal balance of the body.**  
\* **Water has a role in supporting the complex chemical activities in the cell.**

Because water participates directly in the metabolic processes (metabolism), on which the life of living organisms depends.

---

- 37) **Enzymes are similar to chemical catalysts.**

Because they increase the speed of chemical reactions without being affected or changed.

---

- 38) **Enzymes are specialized proteins.**

Because for each enzyme, there is one reactant called the "substrate", so that the shape of the substrate matches the enzyme through what is called the "active site".

---

- 39) **Bony fish contain air bladder.**

Because the air bladder helps the bony fish to float in water.

---

- 40) **Salmon fish resort to migration to fresh water during their life cycle.**

To complete the process of reproduction.

---

- 41) **The suitability of the viperfish for living in the deep depths.**

Because the viperfish is characterized by the flexibility of its skeleton to withstand the high pressure in the depths, and it also has high levels of hemoglobin in its blood to adapt to the low oxygen levels in the depths.

---

- 42) **Deep-depths fish are characterized by having strong and durable arteries and veins.**

To withstand the high pressure exerted on them.



**43 The contractile vacuole in *Amoeba* can be named as an osmoregulatory organ.**

Because the contractile vacuole collects the excess water in the cell, then pushes it towards the cell membrane to discharge its water content outside the cell to maintain the osmoregularity of *Amoeba* with the surrounding medium.

**44 Saltwater organisms' cells don't contain contractile vacuole.**

Because most saltwater organisms swallow large amounts of seawater to compensate the water loss by osmosis, then they get rid of the excess salts by the two kidneys and specialized cells in gills.

**45 The osmotic adaptation process of freshwater fish is different from that in most saltwater fish.**

Because in freshwater fish, large amounts of water pass into their bodies and get rid of excess water by kidneys to protect their bodies from bursting. While most saltwater fish swallow large amounts of seawater to compensate the water loss by osmosis, then get rid of excess salts by the two kidneys and specialized cells in gills.

**46 Urea plays an important role in keeping sharks alive in their environment.**

Because sharks retain a high concentration of urea in their blood, where the high concentration of urea increases the osmotic pressure of the blood to become close to the osmotic pressure of the surrounding water, thus reducing water loss from the bodies of sharks to the surrounding environment.

**47 Gills play a mutual role as an excretory organ and a respiratory organ in most marine fish.**

Because they have specialized cells to get rid of excess salts. Also, they act as a respiratory organ, since they extract the dissolved oxygen in water and get rid of the carbon dioxide produced from respiration process.



- 48 Under normal conditions, the ratio between the concentrations of  $\text{CO}_2$  and  $\text{O}_2$  gases in water differs from that between their concentrations in air.**

Because the concentration of oxygen in air is about 500 times higher than the concentration of carbon dioxide gas, but the solubility of oxygen gas in water is 50 times less than that of carbon dioxide gas.

- 49 The percentage of dissolved oxygen in Red Sea water is higher than its percentage in Gulf of Suez water.**

As the increase in the intensity of waves in Red Sea compared to Gulf of Suez causes an increase in the rate of gases exchange between the atmospheric air and water, therefore the solubility of oxygen gas increases.

- 50 The concentration of  $\text{CO}_2$  and  $\text{O}_2$  gases in the Mediterranean Sea water is lower than that in the Nile River water.**

Because the solubility of both gases in salt water (Mediterranean Sea) is about 20% - 30% less than their solubility in fresh water (Nile River).

- 51 High temperatures in marine environments may threaten the life of aquatic plants.**

Because the solubility of oxygen gas necessary for respiration process and the solubility of carbon dioxide gas necessary for photosynthesis process decrease at higher temperatures.

- 52 The rate of photosynthesis process for an aquatic plant at  $20^\circ\text{C}$  differs from its rate at  $50^\circ\text{C}$ .**

Because the solubility of carbon dioxide gas in water, which is necessary for photosynthesis process, is lower at higher temperatures, therefore the photosynthesis rate decreases with increasing temperatures.

- 53 The high percentage of carbon dioxide gas in the atmosphere affects the pH value of water.**

Because the high levels of  $\text{CO}_2$  gas in the atmosphere cause the



dissolution of  $\text{CO}_2$  gas in water at a higher concentration, which leads to an increase in the concentration of carbonic acid ( $\text{H}_2\text{CO}_3$ ) and therefore a decrease in the pH value of the water.

---

**54 The change in the pH value of water threatens the life of some living organisms.**

As the decrease in the pH value of water means the occurrence of acidification process, which is harmful to many species of aquatic organisms, especially those in sensitive life stages such as egg and larval stages, in addition the increase in the pH value of water (increase the alkalinity of water) negatively affects the sensitive species that adapt to certain pH range.

---

**55 The higher the percentage of carbon dioxide gas in water, the more negatively the respiration process of marine organisms is affected.**

Since the high levels of carbon dioxide in water may lead to a decrease in the percentage of dissolved oxygen, which obstructs the respiration of aquatic organisms.

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**56 The high percentage of carbon dioxide gas in water harms some marine organisms as oysters and corals.**

Because these organisms depend on calcium carbonate to form their shells or skeletons, which is a solid substance that is slightly soluble in water and the increase in carbon dioxide percentage leads to its conversion into calcium bicarbonate (which is soluble in water) and thus the process of calcification decreases, which obstructs the ability of these organisms to build or maintain their skeletons.

---

**57 Food chains may be negatively affected by the decrease in the percentage of carbon dioxide gas dissolved in water.**

As the decrease in the level of dissolved carbon dioxide gas in water can lead to a decrease in the rate of sugar formation such as glucose, which limits the energy reserves in producer organisms such as

phytoplankton and algae and thus the amount of energy available to living organisms in the higher levels of the food chains decreases.

**58 Photosynthesis is not completed in the twilight zone (mid-depth zone) of the ocean.**

Because the amount of light reaching this twilight zone is insufficient for the photosynthesis process to occur.

**59 Solar radiation plays a vital role in maintaining ecological balance in aquatic environments.**

Because solar radiation affects ecological balance in aquatic environments through its direct influence on:

- \* The process of **photosynthesis**, which is the foundation of marine life.
- \* **Water temperature**, which in turn affects the distribution of marine organisms.

**60 Algae and phytoplankton are abundant in the surface layers of the water.**

Because sufficient light is available in the surface layers of water for photosynthesis to produce food.

**61 Coral reefs flourish in shallow waters near the equator.**

Because solar radiation is available throughout the year which stimulates the growth of symbiotic algae that live within the coral tissues and provide them with food, allowing them to thrive.

**62 The decrease in solar radiation in polar regions during winter affects aquatic food chains.**

Because it leads to a significant reduction in photosynthesis rates, which impacts the availability of food for marine organisms.



**63 Water pressure at a point inside it increases with the depth of the point beneath the surface.**

Due to the increase of the weight of the water column above that point.

---

**64 The body structure of organisms living near the surface is less strong compared to deep-sea organisms.**

Because the organisms that live near the surface are exposed to relatively low water pressure.

---

**65 Ray fish does not have a swim bladder.**

To ensure that it does not collapse under the high pressure of the water in the deep.

---

**66 Ray fish has a large liver filled with oils.**

To help it float and control its depth.

---

**67 Organisms in the deep-depths have compact body structures and their bodies contain protein components and internal fluids.**

To make the structure of their bodies suitable for the enormous pressure they are exposed to.

---

**68 There must be a balance in the levels of nitrate and phosphate salts in the aquatic environment for algae.**

Because if the amounts of nutrients necessary for the growth of algae (such as nitrogen and phosphorus) increase excessively, this leads to an abnormal algal blooming, which leads to an ecological imbalance.

---

**69 Predatory fish have an important role in preserving coral reefs.**

Because predatory fish maintain the balance of coral reefs by controlling the numbers of small organisms such as sea urchins, which can destroy the reefs if their numbers increase abnormally.

**70 Overfishing of tuna (predatory) fish can affect the producers in the ecosystem.**

Because the decrease in the numbers of tuna as a result of overfishing can lead to an increase in the numbers of preys that affect the growth of producers, which disrupts the ecological balance in the system.

**71 Using bicycles and public transportation are eco-friendly practices.**

As using bicycles and public transportation reduces carbon emissions compared to using individual means of transportation that run on fossil fuels.

**72 Promoting sustainable development has a great importance to the Egyptian agricultural environment.**

Because it helps to preserve the needs of the current generation of agricultural crops without compromising the ability of future generations to meet their food needs.

**73 Increased competition between individuals of different species has a negative impact on the ecological balance.**

Because competition between individuals of different species leads to the distribution of available resources over a larger number of species, so the share of each individual of food and energy decreases, which can lead to a decrease in the numbers of some species of living organisms, which affects the ecological balance.

**11 What happens when?**

**1 The infiltration of water through the pores of soil and sedimentary rocks.**

Groundwater will be formed.



**2 A plant performs transpiration, "concerning the transport process in the plant".**

The rate of transport in the plant increases due to the increased ascent of water and salts from the root to the upper parts of the plant through the xylem tissue.

---

**3 The polarity of a water molecule.**

- \* Attaching its molecules together or with polar covalent molecules of other substances by hydrogen bonds.
  - \* Dissolving many ionic compounds, polar covalent compounds and compounds with polar molecules.
  - \* Dissolving many salts and dissociating them into hydrated ions.
- 

**4 Adding sodium chloride crystals to water.**

Sodium chloride molecules dissociate into ( $\text{Na}^+$ ) and ( $\text{Cl}^-$ ) ions and water molecules surround the ions, where the negative ( $\text{Cl}^-$ ) ion of the salt is surrounded by the positive hydrogen atoms of water, and the positive ( $\text{Na}^+$ ) ion of the salt is surrounded by the negative oxygen atoms of water.

---

**5 Dissolving ammonium bicarbonate salt in water, "regarding the concentration of  $\text{H}^+$  and  $\text{OH}^-$  ions".**

The concentration of hydrogen ions  $\text{H}^+$  remains equal to the concentration of hydroxide ions  $\text{OH}^-$ .

---

**6 Dissolving sodium bicarbonate salt in water, "regarding the pH value".**

An alkaline solution will be formed and its pH value is greater than 7

---

**7 Dissolving ammonium chloride salt in water, "regarding the pH value".**

An acidic solution will be formed and its pH value is less than 7

**8) The temperature of a solid body increases, "concerning the density of its material".**

The density of the body's material decreases.

---

**9) The temperature of pure water increases from 4°C to 10°C, concerning its density.**

The density of pure water decreases.

---

**10) The temperature of pure water decreases until it reaches 4°C, concerning its density.**

The density of pure water increases.

---

**11) The temperature of pure water decreases from 4°C to 0°C, concerning its density.**

The density of pure water decreases.

---

**12) Fresh water resulting from the melting of ice enters the ocean.**

The fresh water spreads over the surface of the ocean because it is less dense.

---

**13) Fresh water resulting from the melting of ice freezes as it flows into the ocean.**

It forms a thermal insulator between the deep regions of the ocean and the cold atmosphere.

---

**14) A hydrometer is placed in a high-density liquid after it was placed in a lower-density liquid.**

A larger part of the hydrometer floats in the case of the higher-density liquid.

---

**15) The rate of evaporation equals the rate of condensation.**

A dynamic equilibrium occurs between the liquid and its vapor.



- 16 The vapor pressure of a pure liquid equals the atmospheric pressure exerted on its surface.**

The liquid starts to boil.

- 17 Increasing the number of non-volatile substance molecules that dissolved in the solution, "regarding the boiling and freezing points".**

The boiling point of the solution increases and its freezing point decreases.

- 18 The absence of chloroplasts from the cells of a bean plant.**

They will not be able to perform photosynthesis, which is necessary to produce food.

- 19 A living cell does not have a plasma membrane.**

The living cell will not be able to protect its internal components, nor it will be able to regulate the passage of substances into and out of the cell.

- 20 The specific heat of water inside cells decreases.**

Living organisms will not be able to maintain their internal body temperatures stable.

- 21 The absence of enzymes from living cells.**

The cell will need a high activation energy to start the chemical reactions in it, which are necessary for its survival, in addition to the slowdown or stopping of those reactions in the absence of enzymes.

- 22 \* The temperature increases above the optimum temperature for the enzyme action.**

- \* The pH value rises above the optimum value for the enzyme action.**

The activity of the enzyme will gradually decrease until it stops completely.

**23) \* Salmon are unable to migrate to fresh water.**

**\* The absence of behavioral adaptations in salmon.**

They will not be able to reproduce and spawn eggs.

---

**24) The occurrence of acidification, "regarding the life stages of some aquatic organisms".**

It harms many species of aquatic organisms, especially those in sensitive life stages such as egg and larval stages.

---

**25) The numbers of phytoplankton, algae and plants from the aquatic environment decrease, "concerning the food chains".**

A decrease in the rate of sugar formation and reducing energy production as a result of the decrease in the rate of photosynthesis, which produces glucose, and then the amount of energy available to living organisms in the higher levels of food chains decreases.

---

**26) The temperature of aquatic environment increases to 40°C "regarding CO<sub>2</sub> and O<sub>2</sub> gases in water".**

The solubility of CO<sub>2</sub> and O<sub>2</sub> gases in water decreases with increasing temperature and the percentage of dissolved carbon dioxide in water decreases by a greater rate than the decrease in the percentage of dissolved oxygen in water, which affects the life of aquatic organisms.

---

**27) The percentage of dissolved CO<sub>2</sub> in water increases, "regarding the formation of skeleton of mollusks".**

Calcium carbonate (slightly soluble in water) is converted into calcium bicarbonate (soluble in water), so the calcification process decreases, which obstructs the ability of these organisms to build or maintain their skeletons.



**28 Insufficient light, "regarding coral reefs".**

The symbiotic algae that live inside the coral tissues can't perform photosynthesis, so the coral reefs can't obtain their food which leads to their death.

---

**29 Increasing the species of predators in an aquatic ecosystem, "concerning the number of preys".**

It will cause a highly decrease in the number of preys.

---

**30 Small fish which feed on zooplankton are consumed in large quantities by predatory fish.**

It leads to an increase in the numbers of zooplankton, thus causing the imbalance of the aquatic ecosystem.

---

**31 The amounts of nutrients such as nitrogen and phosphorus increase excessively in an aquatic environment.**

It leads to the abnormal algal blooming and hence a disturbance in the aquatic ecosystem.

---

**32 The destruction of natural habitats such as coral reefs and wetlands.**

It causes the loss of biodiversity and disturbance in the aquatic ecosystem.

---

**33 Heavy metals leak into one of the water bodies, "concerning the aquatic organisms".**

It can lead to the death of many aquatic organisms and a disturbance of the ecological balance as a result of the pollution of the water body with heavy metals.

## 1 Scientific terms

|                              |                                                                                                                                                                                                    |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Atmosphere</b>            | A layer of gases surrounding Earth and it is retained by the Earth's gravity.                                                                                                                      |
| <b>Greenhouse gases</b>      | Gases that trap heat in the Earth's atmosphere and prevent it from leaking into space.                                                                                                             |
| <b>Greenhouse effect</b>     | It is the trapping of heat in the Earth's atmosphere, which causes the continuous increase in the temperature of the air near the Earth's surface due to rising concentration of greenhouse gases. |
| <b>Aurora</b>                | A natural phenomenon observed at the poles, appearing as bright, colorful lights in the sky.                                                                                                       |
| <b>Escape velocity</b>       | The minimum speed with which gas molecules must move to escape from a planet's gravity.                                                                                                            |
| <b>Ozone layer</b>           | A layer in the atmosphere that acts as a shield, protecting the Earth from harmful ultraviolet radiation.                                                                                          |
| <b>Ozone layer depletion</b> | It is the gradual deterioration of the protective ozone layer in the atmosphere.                                                                                                                   |
| <b>Smog</b>                  | A phenomenon that is produced from the reaction of ozone gas with nitrogen dioxide and sulphur dioxide gases and fine particles in air.                                                            |
| <b>Conduction</b>            | The method by which heat is transferred between two objects in contact or through a single solid object.                                                                                           |
| <b>Convection</b>            | The method by which heat is transferred in fluids through the movement of parts of the fluid upwards and downwards.                                                                                |

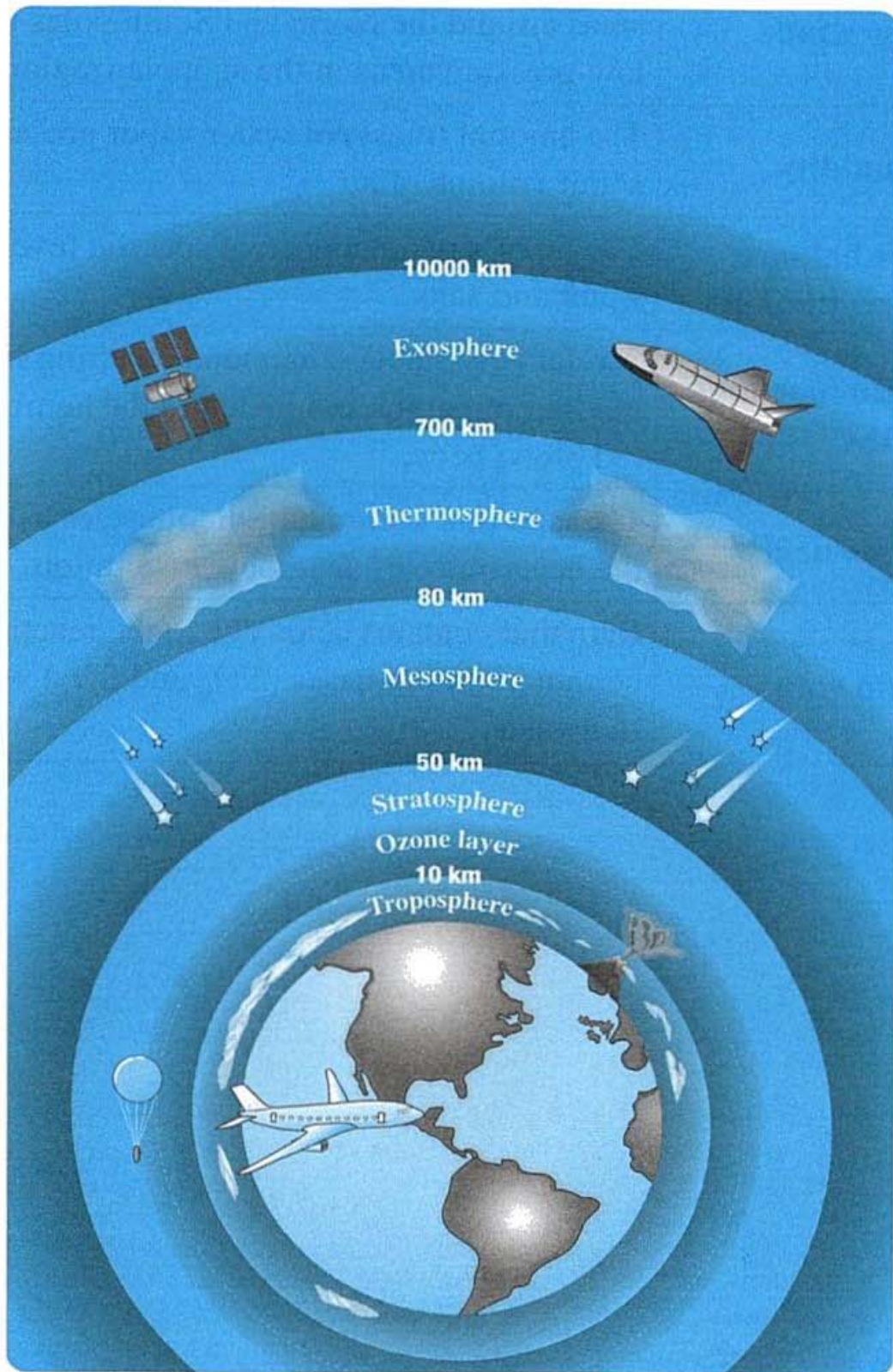


|                                               |                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Radiation</b>                              | The method by which heat is transferred in the form of electromagnetic radiation.                                                                                                                                                                                                                                                                                                                |
| <b>Soaring (Thermal flight)</b>               | A technique used by birds where they use rising hot air currents by convection to float above these currents, allowing them to stay in the air for long periods without constantly flapping their wings for saving energy.                                                                                                                                                                       |
| <b>Isobars</b>                                | Lines on weather maps that connect areas of equal atmospheric pressure.                                                                                                                                                                                                                                                                                                                          |
| <b>Weather maps</b>                           | Maps on which areas of high and low atmospheric pressure are visualized, with lines drawn to connect areas of equal atmospheric pressure.                                                                                                                                                                                                                                                        |
| <b>Standard (Normal) atmospheric pressure</b> | <ul style="list-style-type: none"> <li>* The pressure resulting from the weight of an air column with a unit cross-sectional area, extending from sea level to the top of the atmosphere, at a temperature of zero degree Celsius.</li> <li>* The atmospheric pressure at sea level at zero degree Celsius, which is equivalent to the pressure of a mercury column of height 0.76 m.</li> </ul> |
| <b>Blood</b>                                  | A specialized connective tissue consisting of an intercellular substance called "plasma" in which blood cells are suspended.                                                                                                                                                                                                                                                                     |
| <b>Red blood cells</b>                        | Cells in the blood tissue whose cytoplasm contains hemoglobin.                                                                                                                                                                                                                                                                                                                                   |
| <b>Hemoglobin<br/>"Red-colored pigment"</b>   | A substance found in the cytoplasm of red blood cells responsible for transporting oxygen and a little amount of carbon dioxide gas.                                                                                                                                                                                                                                                             |
| <b>Plasma</b>                                 | The liquid component of blood.                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Blood pressure</b>                         | The force exerted by the blood during its circulation on a unit area of the walls of the blood vessels.                                                                                                                                                                                                                                                                                          |

|                                           |                                                                                                                                    |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| <b>Wind</b>                               | The horizontal movement of air from areas of high atmospheric pressure to areas of low atmospheric pressure.                       |
| <b>Polar winds</b>                        | Dry, cold winds that blow from high-pressure areas around the North and South poles to low-pressure areas in the subpolar regions. |
| <b>Humidity</b>                           | The amount (mass) of water vapor present in a unit volume of air.                                                                  |
| <b>Water balance<br/>"Osmoregulation"</b> | The body's maintenance of specific levels of water and salts.                                                                      |
| <b>Carboxyhemoglobin<br/>(HbCO)</b>       | A relatively stable compound resulting from the binding of carbon monoxide to the hemoglobin of red blood cells.                   |
| <b>Lactic acid</b>                        | The acid that accumulates in muscles as a result of the occurrence of anaerobic respiration.                                       |
| <b>Acid rain</b>                          | Rain that contains acids due to the reaction of certain polluting gases ( $\text{NO}_x$ and $\text{SO}_x$ ) with rainwater.        |



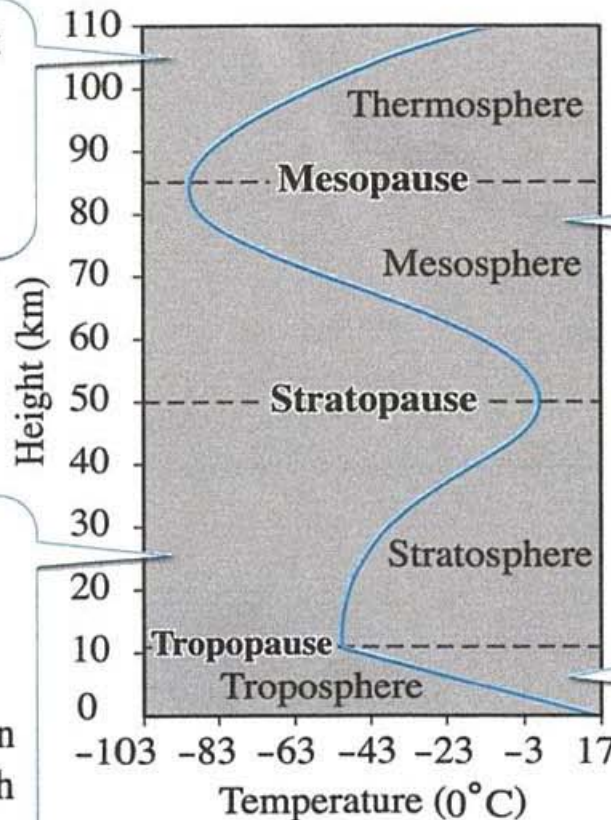
## Layers of the atmosphere



## 2 Temperature in some layers of the atmosphere

This is the hottest layer, where temperatures can exceed  $2000^{\circ}\text{C}$ .

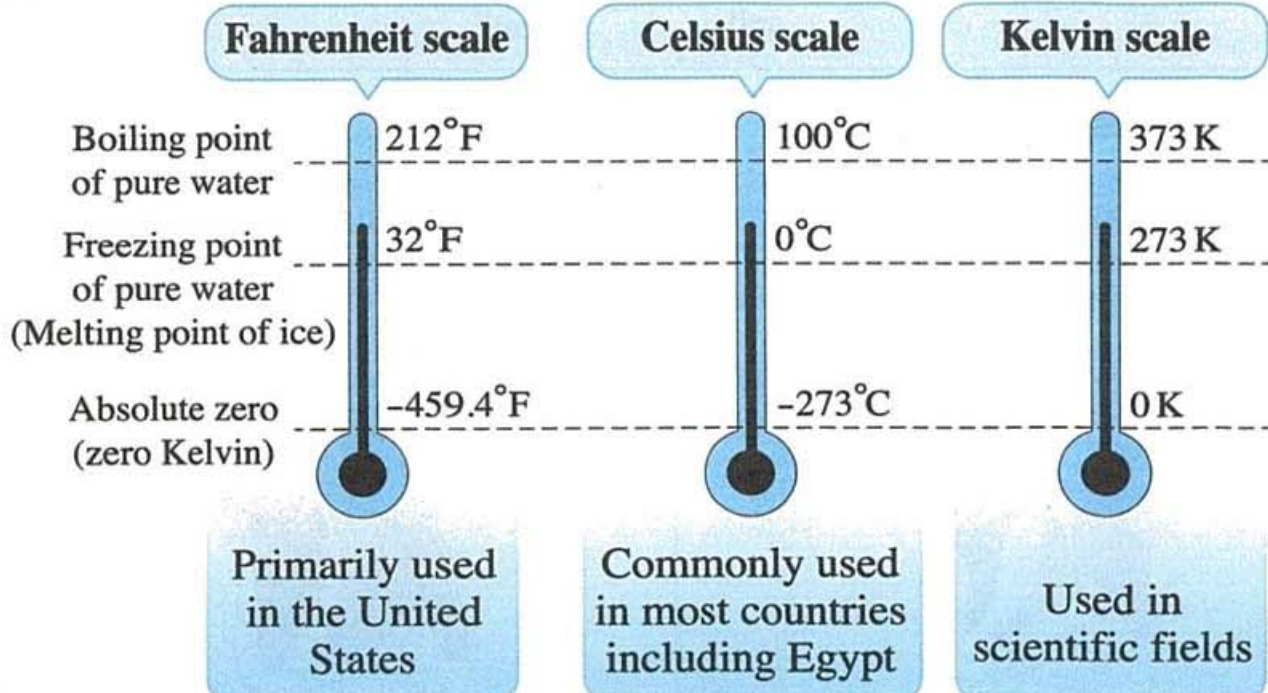
The temperature remains constant up to an altitude of 20 km above the Earth's surface, then it begins to rise with increasing altitude.



This is the coldest layer, where the temperature at its upper boundary reaches  $-93^{\circ}\text{C}$ .

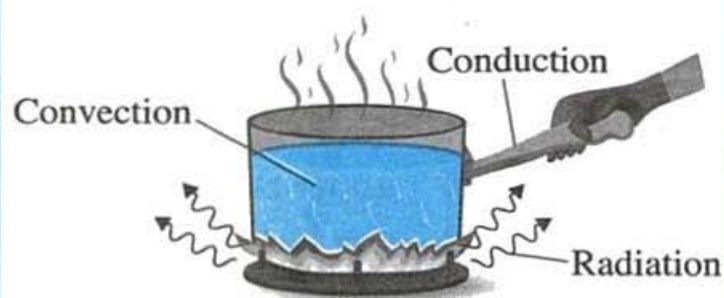
- The average temperature at the Earth's surface is approximately  $15^{\circ}\text{C}$ .
- The air temperature in this layer decreases as altitude increases, at a rate of  $6.5^{\circ}\text{C}$  for every 1000 m.

## 3 Measuring air temperature

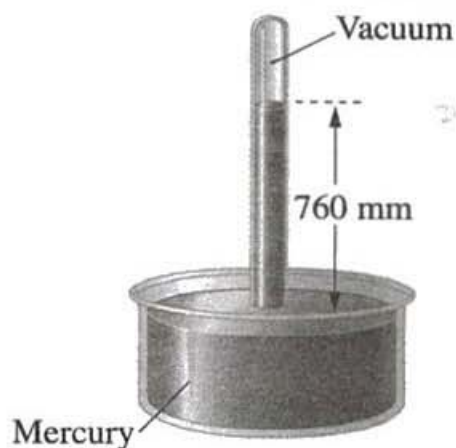




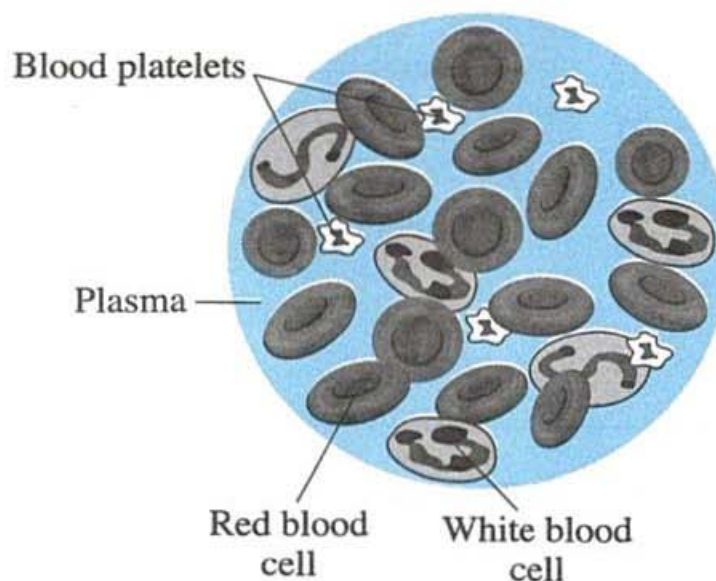
#### 4 Mechanisms of heat transfer



#### 5 The mercury barometer



#### 6 Blood composition



#### 7 Blood pressure in human

##### 1 Systolic pressure

The resulted pressure from the heart (ventricular) contraction.

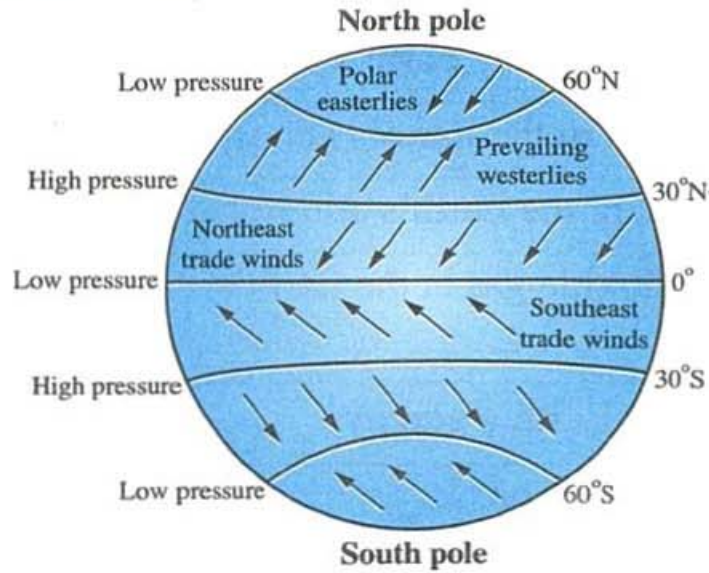


##### 2 Diastolic pressure

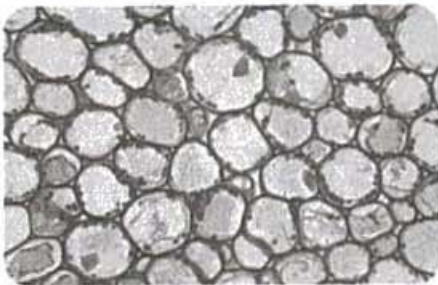
The resulted pressure from the heart (ventricular) relaxation.



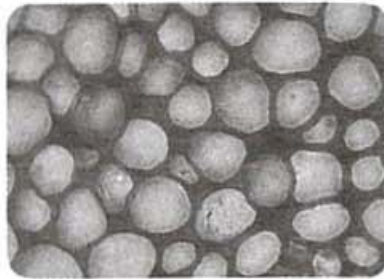
## 8 Global wind systems



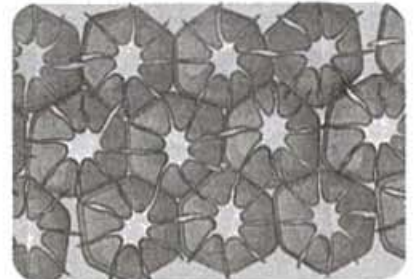
## 9 Tissues in the plant



Parenchyma tissue

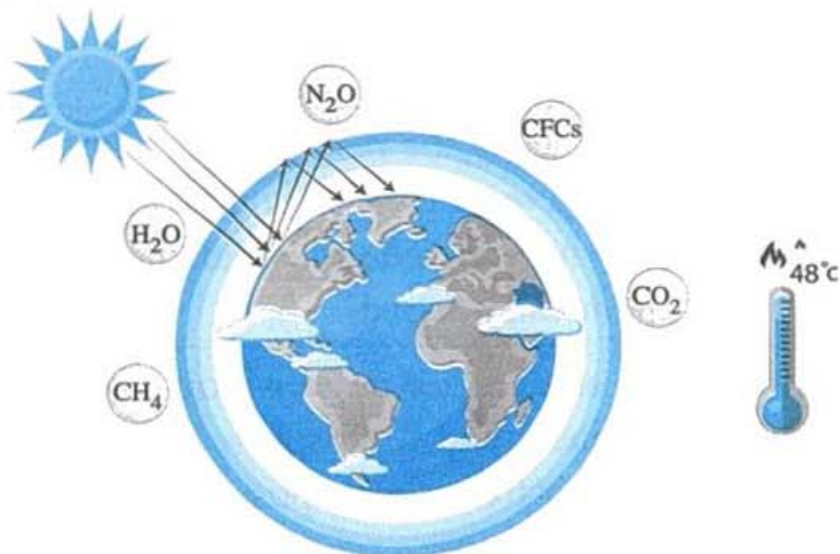


Collenchyma tissue



Sclerenchyma tissue

## 10 Global warming phenomenon





### 3

### Numbers with scientific reference

|                                                             |                 |
|-------------------------------------------------------------|-----------------|
| The volume of nitrogen gas in the Earth's atmosphere.       | About 78%       |
| The volume of oxygen gas in the Earth's atmosphere.         | About 21%       |
| The volume of argon gas in the Earth's atmosphere.          | About 0.93%     |
| The volume of carbon dioxide gas in the Earth's atmosphere. | About 0.04%     |
| Escape velocity ( $v_e$ ) from Earth's gravity.             | 11.2 km/s       |
| Near ultraviolet radiation (UVA).                           | 315 nm - 400 nm |
| Medium ultraviolet radiation (UVB).                         | 280 nm - 315 nm |
| Far ultraviolet radiation (UVC).                            | 100 nm - 280 nm |
| Normal blood pressure for healthy adults.                   | 120/80 mm Hg    |

### 4

### Importance and uses

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>The Earth's atmosphere</b> | <ul style="list-style-type: none"> <li>* It acts as an insulating shield, protecting Earth from most harmful solar radiations and from incoming objects from space.</li> <li>* It retains part of solar radiation, helping to maintain moderate and life-sustaining temperatures.</li> <li>* It plays a fundamental role in the water cycle in nature, allowing fresh water to be distributed across the Earth's surface.</li> </ul> |
| <b>Oxygen gas</b>             | <ul style="list-style-type: none"> <li>* Essential for the respiration of living organisms.</li> <li>* The active element in combustion processes and many natural and industrial chemical reactions (chemically active).</li> </ul>                                                                                                                                                                                                 |
| <b>Tropopause layer</b>       | It acts as a barrier or transitional zone between the troposphere and stratosphere, preventing the mixing of cold air from the troposphere with warm air from the stratosphere.                                                                                                                                                                                                                                                      |

|                                        |                                                                                                                                                                                                                                                                                                                        |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Ozone layer in the stratosphere</b> | It protects living organisms on Earth's surface from the harmful effects of short-wave ultraviolet radiation.                                                                                                                                                                                                          |
| <b>Ionosphere layer</b>                | <ul style="list-style-type: none"> <li>* It is used in long-distance wireless communications due to its ability to reflect radio waves.</li> <li>* The aurora (polar lights) phenomenon occurs in it.</li> </ul>                                                                                                       |
| <b>Ultraviolet rays</b>                | <ul style="list-style-type: none"> <li>* <b>They can be produced by special lamps to be used in:</b> <ul style="list-style-type: none"> <li>- Sterilizing surgical instruments and laboratory equipment to avoid microbial contamination.</li> <li>- Detecting counterfeit banknotes in stores.</li> </ul> </li> </ul> |
| <b>The mercury barometer</b>           | Measuring atmospheric pressure.                                                                                                                                                                                                                                                                                        |
| <b>Red blood cells</b>                 | Their cytoplasm contains hemoglobin (red-colored pigment) that is responsible for transporting oxygen and a little amount of carbon dioxide gas.                                                                                                                                                                       |
| <b>White blood cells</b>               | They protect the body from bacteria, viruses, fungi and other foreign substances.                                                                                                                                                                                                                                      |
| <b>Blood platelets</b>                 | They participate in blood clotting during bleeding.                                                                                                                                                                                                                                                                    |
| <b>Parenchyma tissue</b>               | <ul style="list-style-type: none"> <li>* Performing photosynthesis process.</li> <li>* Storing nutrients and water.</li> <li>* Secreting the sap.</li> <li>* Helping in ventilation.</li> </ul>                                                                                                                        |
| <b>Collenchyma tissue</b>              | It provides some strength, flexibility and elasticity to the growing parts of the plant.                                                                                                                                                                                                                               |
| <b>Sclerenchyma tissue</b>             | It provides a significant mechanical strength to the plant.                                                                                                                                                                                                                                                            |
| <b>Hygrometer</b>                      | Measuring the percentage of humidity in the air.                                                                                                                                                                                                                                                                       |
| <b>Water balance process</b>           | <ul style="list-style-type: none"> <li>* It keeps blood pressure at a normal level.</li> <li>* It ensures the continuity of biochemical reactions inside cells.</li> <li>* It prevents dehydration, which can lead to dizziness or kidney failure in severe cases.</li> </ul>                                          |



|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Gas scrubbers</b>                      | They are installed in the chimneys of factories and power plants to remove sulphur and nitrogen oxides before they are emitted into the atmosphere.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Satellites and remote sensing</b>      | <p>* <b>Satellites perform multiple tasks to monitor the components of the atmosphere and their interactions, where:</b></p> <ul style="list-style-type: none"> <li>- Remote sensing devices aboard satellites measure the concentrations of gases responsible for the global warming phenomenon, such as carbon dioxide and methane.</li> <li>- They continuously monitor the state of the ozone layer, detect any depletion and track its recovery over time.</li> <li>- They provide us with data on cloud movement and wind patterns, helping meteorologists understand how weather and climate patterns are changing.</li> </ul> |
| <b>Meteorological monitoring stations</b> | <p>* <b>Weather stations distributed around the world measure:</b></p> <ul style="list-style-type: none"> <li>- Temperature.</li> <li>- Atmospheric pressure.</li> <li>- Humidity percentage.</li> <li>- Wind speed.</li> <li>- Pollutant concentrations.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                  |

## 5 Laws and problems

**Calculating** the temperature at a certain altitude above the Earth's surface in the troposphere:

The temperature decreases by  $6.5^{\circ}\text{C}$  for every 1000 m of elevation.

**Example**

**Choose:** If the temperature at the foot of Mount Catherine is  $20^{\circ}\text{C}$ , then the temperature at an altitude of 800 m above the foot of the mountain equals .....

(a)  $25.7^{\circ}\text{C}$

(b)  $-25.7^{\circ}\text{C}$

(c)  $14.8^{\circ}\text{C}$

(d)  $-14.8^{\circ}\text{C}$

**Solution**

$$t_{\text{Foot}} = 20^{\circ}\text{C}$$

$$h = 800 \text{ m}$$

$$t_{\text{Mountain}} = ?$$

$\therefore$  The temperature decreases by  $6.5^{\circ}\text{C}$  as we climb up 1000 m of altitude.

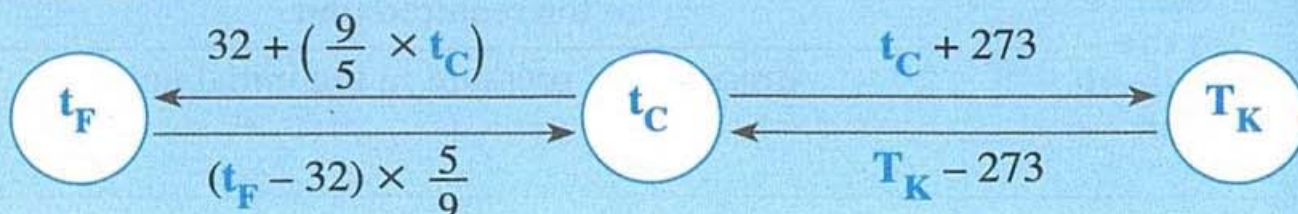
$$\therefore \Delta t = \frac{800}{1000} \times 6.5 = 5.2^{\circ}\text{C}$$

$$\therefore t_{\text{Mountain}} = t_{\text{Foot}} - \Delta t = 20 - 5.2 = 14.8^{\circ}\text{C}$$

$\therefore$  The correct choice is (c).

**The conversion between different temperature scales:**

It is possible to convert between the temperature on the Celsius scale ( $t_{\text{C}}$ ) and the temperature on either Kelvin ( $T_{\text{K}}$ ) or Fahrenheit ( $t_{\text{F}}$ ) scales as follows:





**Example**

If the temperature of a sick person is  $40^{\circ}\text{C}$ , **what** is his temperature on each of the following?

- (1) Kelvin scale.
- (2) Fahrenheit scale.

**Solution**

$$t_{\text{C}} = 40^{\circ}\text{C}$$

$$T_{\text{K}} = ?$$

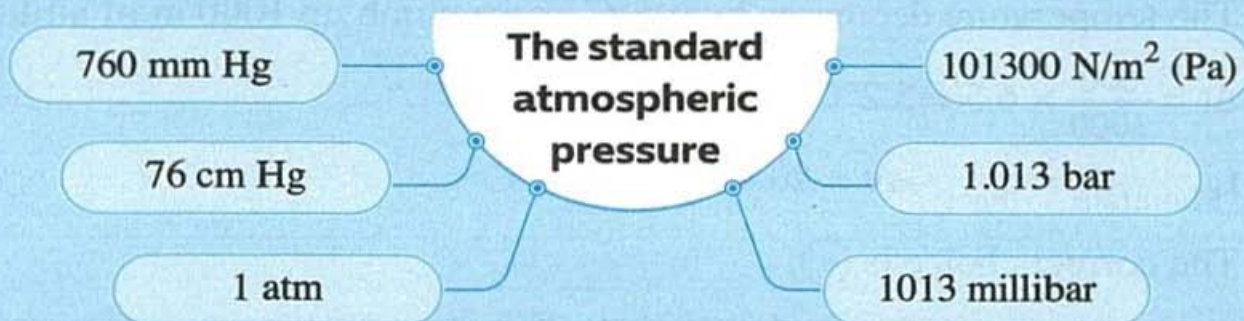
$$t_{\text{F}} = ?$$

$$(1) T_{\text{K}} = t_{\text{C}} + 273 = 40 + 273 = 313 \text{ K}$$

$$(2) t_{\text{F}} = \frac{9}{5} t_{\text{C}} + 32 = \left(\frac{9}{5} \times 40\right) + 32 = 104^{\circ}\text{F}$$

**3**

The standard atmospheric pressure can be expressed in several units:



It is possible to convert between the atmospheric pressure units using the following relation:

Pressure  
in the  
required  
unit



The quantity to be converted  $\times$  Atmospheric pressure  
in the required unit

Atmospheric pressure in the initial unit

**Example** If you know that the atmospheric pressure in a location is equal to 950 millibar, **what** is the equivalent value to this pressure in the following units?

- 

$$\text{Pressure in the required unit} = \frac{\text{The quantity to be converted} \times \text{Atmospheric pressure in the required unit}}{\text{Atmospheric pressure in the initial unit}}$$

(4) The atmospheric pressure in mm Hg =  $\frac{950 \times 760}{1013}$   
= **712.73 mm Hg**

**1 On which the effective velocity of gas molecules ( $v_{rms}$ ) depend?**

- (Where the effective velocity has a greater value for the molecules of less masses and higher temperatures)

(1) Heat. (2) Atmospheric pressure.  
(3) Wind. (4) Humidity.

**(2) Temperature:** as the temperature rises, the rate of water evaporation increases and the air molecules move apart, increasing the amount of water vapor that a unit volume of air can carry, i.e. the humidity of air increases and vice versa.



| 1                                    | Troposphere                                                                            | Stratosphere                                                                                                                                                      | Mesosphere                                                                                    | Thermosphere                                                                                                                                | Exosphere                                                                                                                       |
|--------------------------------------|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Order</b>                         | The closest layer to the Earth's surface.                                              | The layer above the troposphere (second layer).                                                                                                                   | The layer above the stratosphere (third layer).                                               | The layer above the mesosphere (fourth layer).                                                                                              | The highest layer of the atmosphere.                                                                                            |
| <b>Altitude from Earth's surface</b> | Extends up to about 10 km.                                                             | Extends up to 50 km above Earth's surface (about 40 km thick).                                                                                                    | Extends up to 80 km above Earth's surface (about 30 km thick).                                | Extends up to 700 km above Earth's surface.                                                                                                 | Extends up to 10000 km above Earth's surface.                                                                                   |
| <b>Importance</b>                    | Most weather and climate phenomena occur in it (such as, cloud formation, rain, wind). | * Contains the ozone layer, which protects living organisms from harmful UV radiation.<br>* Preferred layer for aircrafts flights due to horizontal air movement. | Most meteors burn up in this layer, which makes it play a vital role in protecting the Earth. | * It contains the ionosphere in its lower part that is used for long-distance radio communication.<br>* The aurora phenomenon occurs in it. | The ideal region for satellites and spacecrafts, as they face almost no resistance, which allow them to orbit for long periods. |

| <div>2</div> <div>Conduction</div>                                                                                                                                                                                                                                                                                     | <div>Convection</div>                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>* The transfer of heat inside solid materials or through direct contact.</li> <li>* Thermal energy is transferred from the molecules of higher temperatures to that of lower temperatures <b>without the movement of the molecules themselves from their places.</b></li> </ul> | <ul style="list-style-type: none"> <li>* The transfer of heat in fluids (liquids and gases).</li> <li>* The higher-temperature parts of the fluid which have less density move upwards allowing the lower-temperature parts of the fluid (of higher density) to sink down and replace their positions, i.e., <b>the thermal energy is transferred along with the movement upward of the fluid's parts.</b></li> </ul> |



| 3                        | Wood frog                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Icefish                                                                                                                                                                                                                                                                                                                                                                                                          | Thorny devil lizard                                                                                                                                                                              |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Habitat</b>           | Cold northern regions such as Alaska and Canada.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Frozen water in Antarctica.                                                                                                                                                                                                                                                                                                                                                                                      | Extremely hot environments such as deserts.                                                                                                                                                      |
| <b>Adaptation method</b> | <p>★ <b>When the temperature decreases in winter:</b><br/>The body partially freezes and enters in a deep hibernation, where:</p> <ul style="list-style-type: none"> <li>- Heart stops beating and it stops breathing but doesn't die.</li> <li>- It produces large amounts of glucose in its vital organs before freezing, which act as an antifreeze substance.</li> </ul> <p>★ <b>When the temperature rises in the spring:</b><br/>The ice melts and the heart starts to beat, then the vital functions begin to work again.</p> | <p>★ <b>When the water temperature decreases:</b></p> <ul style="list-style-type: none"> <li>- It secretes special proteins in its blood "antifreeze proteins" which prevent the formation of ice crystals in the blood and tissues of the fish.</li> <li>- It absorbs oxygen directly from the water, where its blood doesn't contain hemoglobin that is essential for transporting oxygen in blood.</li> </ul> | It has small channels on its skin surface that help it to collect the moisture from air or even from sand and direct towards its mouth, helping it to stay hydrated in a dry desert environment. |

| 4                  | Parenchyma tissue                                                                                                                                                                                                                                                                                                 | Collenchyma tissue                                                                                                                                                                                                                         | Sclerenchyma tissue                                                                                                                                                                                                                                                             |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b> | <p><b>* A living tissue whose cells are characterized by:</b></p> <ul style="list-style-type: none"> <li>- Thin cell walls composed mainly of cellulose.</li> <li>- Containing a large number of chloroplasts filled with starch.</li> <li>- Containing large vacuoles filled with water and minerals.</li> </ul> | <p><b>* A living tissue whose cells are characterized by:</b></p> <ul style="list-style-type: none"> <li>- Being longer than parenchyma cells.</li> <li>- Having irregularly thickened cell walls made of cellulose and pectin.</li> </ul> | <p><b>* A non-living (dead) tissue whose cells are characterized by:</b></p> <ul style="list-style-type: none"> <li>- Being rigid and impermeable to water due to their very thick cell walls made of cellulose and lignin.</li> <li>- Older cells are usually dead.</li> </ul> |
| <b>Location</b>    | Forms most of the soft tissues within various plant parts like leaves, stems and roots.                                                                                                                                                                                                                           | Usually found beneath the epidermis of leaf veins and stems, especially small stems.                                                                                                                                                       |                                                                                                                                                                                            |



| 5 Effect of high or low humidity levels on human |                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                      |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                  | At high humidity                                                                                                                                                                                                                                               | At low humidity (dry conditions)                                                                                                                                                                                                                                                                     |
| <b>Sweat evaporation rate</b>                    | Slower                                                                                                                                                                                                                                                         | Faster                                                                                                                                                                                                                                                                                               |
| <b>Body's ability to cool itself</b>             | Decreases                                                                                                                                                                                                                                                      | Increases                                                                                                                                                                                                                                                                                            |
| <b>Harmful effects</b>                           | <ul style="list-style-type: none"> <li>* Feeling hotter and more fatigued quickly.</li> <li>* Prolonged exposure to high humidity may cause:               <ul style="list-style-type: none"> <li>- Heat stress.</li> <li>- Heatstroke.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>* Chapped lips.</li> <li>* Dry skin.</li> <li>* Dryness of mucous membranes in the nose and respiratory system, which increases the risk of respiratory infections.</li> <li>* Rapid water loss from the body, increasing the risk of dehydration.</li> </ul> |

| 6                       |                                                                                                               |                                                                                                                                                                                                                                       |
|-------------------------|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                         | Carbon monoxide (CO)                                                                                          | Sulphur dioxide (SO <sub>2</sub> )                                                                                                                                                                                                    |
| <b>Description</b>      | Colourless and odourless polluting gas.                                                                       | A polluting gas contributes to the formation of acid rain.                                                                                                                                                                            |
| <b>Formation reason</b> | It is usually produced by the incomplete combustion of fossil fuels (such as gasoline, coal and natural gas). | <b>It is mainly emitted from:</b> <ul style="list-style-type: none"> <li>- The combustion of coal and oil in power plants and factories.</li> <li>- Certain industrial processes such as oil refining and metals smelting.</li> </ul> |

| 7         | Sulphuric acid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Nitric acid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Formation | <ul style="list-style-type: none"> <li>* Sulphur dioxide (<math>\text{SO}_2</math>) reacts with oxygen (<math>\text{O}_2</math>) to form sulphur trioxide (<math>\text{SO}_3</math>).</li> <li>* This reaction occurs in the presence of catalysts such as sunlight.</li> </ul> <div data-bbox="352 651 890 757"> <math display="block">2\text{SO}_{2(g)} + \text{O}_{2(g)} \xrightarrow{\text{Sunlight}} 2\text{SO}_{3(g)}</math> </div> <ul style="list-style-type: none"> <li>* Then, sulphur trioxide reacts with water droplets in clouds to form sulphuric acid (<math>\text{H}_2\text{SO}_4</math>), which is a very strong acid.</li> </ul> <div data-bbox="352 1196 890 1294"> <math display="block">\text{SO}_{3(g)} + \text{H}_2\text{O}_{(l)} \longrightarrow \text{H}_2\text{SO}_{4(aq)}</math> </div> | <ul style="list-style-type: none"> <li>* Nitrogen oxides (<math>\text{NO}_x</math>) react with water to form nitric acid (<math>\text{HNO}_3</math>).</li> <li>* In the equation reaction, nitric acid and nitrous acid (<math>\text{HNO}_2</math>) are formed.</li> </ul> <div data-bbox="927 651 1474 808"> <math display="block">2\text{NO}_{2(g)} + \text{H}_2\text{O}_{(l)} \longrightarrow \text{HNO}_{2(aq)} + \text{HNO}_{3(aq)}</math> </div> <ul style="list-style-type: none"> <li>* In general, the reaction can be summarized as follows:</li> </ul> <div data-bbox="927 1016 1474 1173"> <math display="block">4\text{NO}_{2(g)} + \text{O}_{2(g)} + 2\text{H}_2\text{O}_{(l)} \longrightarrow 4\text{HNO}_{3(aq)}</math> </div> |



|                                 | Harmful effect                                                                                                                                                                                   | Reason                                                                                                                                                                                                                                                                         |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| On human health                 | <b>* Irritation in the respiratory tract and increasing the probability of:</b> <ul style="list-style-type: none"> <li>- Asthma attacks.</li> <li>- Bronchitis.</li> <li>- Pneumonia.</li> </ul> | Direct inhalation of $\text{SO}_2$ and $\text{NO}_2$ gases.                                                                                                                                                                                                                    |
|                                 | Harms the lungs and reduces respiratory capacity                                                                                                                                                 | Formation of ground-level ozone ( $\text{O}_3$ ) secondarily.<br>$\text{NO}_x + \text{Volatile organic compounds} \xrightarrow{\text{Sunlight}} \text{Ground-level ozone}$                                                                                                     |
| On plants                       | Direct damage to leaves.                                                                                                                                                                         | <b>* Entry of gases like <math>\text{SO}_2</math> and <math>\text{NO}_2</math> through stomata, which causes:</b> <ul style="list-style-type: none"> <li>- Deformation in the stomata.</li> <li>- Oxidation reactions in leaves.</li> <li>- Damage to leaf tissues.</li> </ul> |
|                                 | Reducing photosynthesis rate.                                                                                                                                                                    | Damaged chlorophyll and clogged stomata, which decrease the absorption of $\text{CO}_2$ and consequently, the production of glucose.                                                                                                                                           |
|                                 | Nutrients depletion and loss of essential elements for plant growth.                                                                                                                             | Acid rain replaces essential salts like calcium and magnesium salts from the soil, reducing its fertility.                                                                                                                                                                     |
| On buildings and infrastructure | Corrosion and damage of monuments and historical buildings.                                                                                                                                      | The reaction of acids with limestone ( $\text{CaCO}_3$ ).<br>$\text{H}_2\text{SO}_{4(aq)} + \text{CaCO}_{3(s)} \xrightarrow{\text{(Sparingly soluble in water)}} \text{CaSO}_{4(aq)} + \text{CO}_{2(g)} + \text{H}_2\text{O}_{(l)}$ (Soluble in water)                         |

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b>  | <p>* <b>Powerful computer programs are characterized by:</b></p> <ul style="list-style-type: none"> <li>- Simulating the Earth's climate system by inputting the current and future data, <b>such as:</b> gas emission levels.</li> <li>- Describing the movement and interactions of the atmosphere.</li> <li>- Relying on physical, chemical and biological equations.</li> </ul>                                                                                                                                                                   |
| <b>Objectives</b>   | <p>* <b>Climate models enable the prediction of the long-term effects of human activities such as:</b></p> <ul style="list-style-type: none"> <li>- The effect of burning fossil fuels on carbon dioxide accumulation.</li> <li>- The effect of deforestation on the carbon cycle and gas balance.</li> </ul>                                                                                                                                                                                                                                         |
| <b>Data sources</b> | Satellites and weather monitoring stations, where the collected data by each of them are used to create complex climate models.                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Applications</b> | <p>* <b>Through climate models, scientists can predict some potential changes such as:</b></p> <ul style="list-style-type: none"> <li>- Rising temperatures: Scientists use climate models to predict that the continuous increase in carbon dioxide in the atmosphere leads to increasing the average temperature of the Earth by approximately (<math>1.5^{\circ}\text{C} - 2^{\circ}\text{C}</math>) over the coming decades.</li> <li>- Changing rainfall patterns.</li> <li>- Increasing the frequency of extreme weather conditions.</li> </ul> |

|                         |                                                                                                                                                |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>In public health</b> | Forecasting the pollution levels or increased ultraviolet radiation helps in protecting human from respiratory system diseases or skin cancer. |
| <b>In agriculture</b>   | Forecasting temperatures and rainfall enable farmers to choose appropriate planting and harvesting times.                                      |
| <b>In ecosystems</b>    | Predicting changes helps in protecting sensitive organisms and plan environmental conservation programs.                                       |



11

## The effect of the weather monitoring stations forecasting a strong storm along the expected migration path of the bird flocks

|                                           |                                                                                                                                                             |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Potential damage of the storm</b>      | Death of large numbers of birds and the risk of losing some species, as some birds rely on long intercontinental migration routes during migration seasons. |
| <b>Actions taken based on forecasting</b> | Wildlife protection centers issued environmental warnings, which helped in:<br>* Rerouting some migration paths.<br>* Reduce hunting during that period.    |
| <b>Result of the taken actions</b>        | Helped in protecting large numbers of birds from death, due to exhaustion or collision during the storm.                                                    |

## 8 Remember that

- 1 The proportions of the atmospheric components are continuously changing due to various natural processes, **such as**:
  - (1) **Some biological processes that are carried out by living organisms, as in the process of:**
    - **Respiration:** Living organisms consume oxygen from the air and release carbon dioxide.
    - **Photosynthesis:** Plants absorb carbon dioxide from the air and release oxygen.
  - (2) **Geological phenomena:** Such as volcanic eruptions, which add large amounts of gases to the atmosphere.
- 2 Nitrogen gas is released into the atmosphere during the decomposition of dead plants and animals or as part of the gases released from volcanoes.
- 3 The existence of life in the troposphere is directly linked to its characteristics, **where**:
  - \* It contains essential gases for life, such as oxygen, carbon dioxide, water vapor and some other gases.
  - \* Its suitable temperature allows biological processes to occur.
  - \* Its atmospheric pressure is suitable for most living organisms.

4 The interaction between suitable environmental conditions and the great diversity of living organisms makes the troposphere the most biologically active and essential for sustaining life on Earth.

---

5 The charged particles in the ionosphere result from the ionization of oxygen and nitrogen atoms, caused by high-frequency solar radiation like X-rays and gamma rays.

---

6 **The reason of occurrence of aurora phenomenon:**

- \* When high-energy charged particles from the Sun (part of solar wind) reach Earth, the planet's magnetic field directs them toward the poles, so they collide with atoms and ions in the ionosphere, causing them to become excited.
  - \* When these atoms return to their lower energy state, they release photons of various wavelengths, creating the bright lights we see in the sky.
- 

7 The presence of satellites in the exosphere directly impacts our daily lives, **as they:**

- \* Facilitate international communications and wireless internet.
  - \* Form an essential part of the Global Positioning System (GPS).
  - \* Provide accurate weather and climate data, which helps in predicting natural disasters.
  - \* Monitor the Earth and outer space and enhance our understanding of the universe.
- 

8 Ultraviolet rays are from electromagnetic spectrum types and they are invisible rays that propagate in space (vacuum) as electromagnetic waves and they have short wavelengths and high energy compared to visible spectrum.

---

9 \* Ultraviolet rays (photons of electromagnetic spectrum) with wavelengths shorter than 240 nm are absorbed by nitrogen ( $N_2$ ), oxygen ( $O_2$ ) molecules and atomic oxygen (O) to form ozone gas.

\* Ultraviolet rays with wavelengths range from 240 nm : 310 nm are absorbed by ozone found in stratosphere.

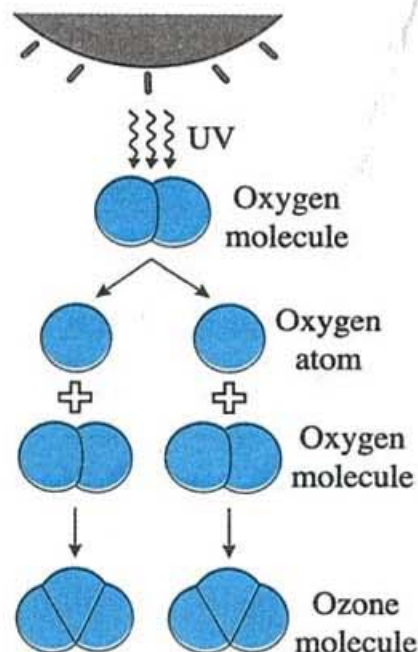


**10 The steps of the formation of ozone gas (O<sub>3</sub>) in the stratosphere:**

- (1) Oxygen molecule absorbs ultraviolet rays (UV) with a wavelength shorter than 240 nm, which causes the breakdown of the covalent bond in oxygen molecule (O<sub>2</sub>), giving two free (individual) oxygen atoms (2O) which is known as photodissociation.



- (2) Each free (individual) oxygen atom (O) binds with another oxygen molecule (O<sub>2</sub>) to form ozone molecule (O<sub>3</sub>).



**11 From the effects of ultraviolet rays on human health:**

- (1) Increased exposure to ultraviolet (UV) rays leads to DNA damage in skin cells, which cause genetic mutations that may result in skin cancers, such as melanoma.
- (2) They affect certain immune cells, such as helper T-cells, which leads to a weakened immune response and makes the body more vulnerable to diseases and infections.
- (3) The absorption of ultraviolet (UV) rays by the eye's lens accelerates the occurrence of cataract, which leads to reducing the light transmittance of to the retina.

**12 From the negative impacts of ground-level ozone (ozone in the troposphere):**

- (1) The formation of smog.
- (2) It negatively affects the plants **which leads to:**
  - Burning of the plant leaves that reduces their ability to perform photosynthesis process.
  - The damage of plants and agricultural crops which affects their growth and productivity (quality).
- (3) Corrosion of some materials such as plastic and rubber.

13 The sun is the main source of heat and light on the Earth's surface.

**So, when sun rays reach the Earth:**

- (1) The temperature of the Earth's surface (land and water) rises more than that of the atmosphere.
- (2) Heat is transferred from the Earth's surface to the atmosphere.
- (3) The temperature of the atmosphere begins to rise, and the air layers closer to the Earth's surface become warmer than the layers farther away.

14 When the temperature changes by one degree on the Celsius scale, **it changes by an amount of:**

- \* 1 unit on the Kelvin scale.
- \* 1.8 degrees on the Fahrenheit scale.

15 In heat transfer by radiation, heat travels as electromagnetic radiation, which spreads in all directions and can propagate through space as well as through material mediums like gases.

16 The millibar (mbar) unit is used to express the atmospheric pressure on weather maps.

17 **A high percentage of humidity in the air affects:**

- (1) **Weather:** Increasing the probability of cloud formation and rainfall.  
For example, in tropical regions with high humidity, heavy rains support the growth of dense forests.
- (2) **Animals:** Decreasing the rate of sweat evaporation, which reduces the efficiency of lowering body temperature.
- (3) **Plants:** Decreasing the rate of transpiration, which reduces the uptake of water and salts from the roots to the leaves.
- (4) **Human:** Slowing down the rate of sweat evaporation, which makes the body less able to cool itself, leading to:
  - Feeling hotter and more fatigued quickly.
  - Heat stress or heatstroke with prolonged exposure.



18 The suitable humidity level for humans is 40% to 60%. A significant deviation from this can harm cells and their ability to function properly.  
**For example, when humidity is low in air:**

- (1) The body loses water faster by:
  - Sweating through skin.
  - Exhalation through lungs.
- (2) Special receptors in the brain sense this water deficiency.
- (3) The kidneys reabsorb water from the urine, making it more concentrated, due to the lack of water in it.

This helps the body maintain stable fluid levels even in dry conditions.

19 **From the strategies to reduce global warming:**

- (1) Using public transportation instead of vehicles to reduce car exhaust emissions.
- (2) Improving energy efficiency in houses and factories by using energy-effective technologies like LED lamps, high-efficiency electrical appliances and clean renewable energy sources, **such as:** solar, wind and hydropower.
- (3) Increasing green spaces (afforestation) by planting trees to help improving the air quality.

20 **Examples of greenhouse gases:**

- |                                                 |                                           |
|-------------------------------------------------|-------------------------------------------|
| (1) Carbon dioxide gas ( $\text{CO}_2$ ).       | (2) Methane gas ( $\text{CH}_4$ ).        |
| (3) Nitrous oxide gas ( $\text{N}_2\text{O}$ ). |                                           |
| (4) Chlorofluorocarbons compounds (CFCs).       | (5) Water vapor ( $\text{H}_2\text{O}$ ). |

21 **From the consequences of global warming phenomenon:**

- (1) Melting of polar ice caps that causes:
  - The flooding of coasts and the disappearance of some coastal cities.
  - The extinction of some polar species, due to the destruction of their natural habitats, which leads to decreasing biodiversity and disturbing the ecological balance.
- (2) Severe climate changes, such as hurricanes, floods and drought periods.

22 **Among the most important air pollutants are:**

- (1) Carbon monoxide ( $\text{CO}$ ).
- (2) Sulphur oxides (Sulphur dioxide  $\text{SO}_2$  – Sulphur trioxide  $\text{SO}_3$ ).
- (3) Nitrogen oxides (Nitrogen monoxide  $\text{NO}$  – Nitrogen dioxide  $\text{NO}_2$ ).

**23 The reasons for the formation of nitrogen oxides ( $\text{NO}_x$ ):**

- \* They can be formed naturally from lightning.
- \* They are generated in large quantities during fuel combustion at high temperatures in:
  - Car engines.
  - Power stations.
  - Industrial furnaces.

**24 The Impact of air pollution and acid rain on the sustainability of ecosystems and human:**

- (1) Reducing the biological productivity (forests, water bodies and wild plants) which affects food and resources.
- (2) Loss of biodiversity due to the death of sensitive species or disruption of their functional role.
- (3) Decreasing air and water quality.
- (4) Imposing health and economic burden on communities (healthcare, building repairs and resource loss).

**25 In 1985, the meteorological monitoring station in Antarctica, operated by the British meteorological office, revealed a large hole in the ozone layer.**

**Monitoring results:**

It led to the launch of the Montreal Protocol in 1987, an international agreement that limited the use of ozone-depleting substances such as chlorofluorocarbons (CFCs). As a result, the ozone layer began to gradually recover, helping to protect humans and living organisms.

**26 The effect of rising water temperature on coral reefs.**

It leads to coral bleaching, where symbiotic algae are expelled from their tissues, causing the corals to lose their primary source of food and energy.

**9 Reasons and explanations**

- 1** \* **The percentage of oxides of nitrogen gas in the air is very low.**  
\* **Oxygen and nitrogen gases coexist in the atmosphere without reacting under normal conditions.**

Because nitrogen gas is largely inert and does not react easily with other gases and elements under normal conditions and it needs special conditions such as lightning or extremely high temperatures to interact.



**2 The importance of carbon dioxide gas for plants.**

Because it is necessary for plants to carry out photosynthesis.

---

**3 \* Air temperature decreases with altitude in the troposphere.**

**\* The temperature at the summit of a mountain is lower than at its base.**

Because as altitude increases from the Earth's surface:

- The air expands due to lower atmospheric pressure and acquires the energy needed for this expansion from the kinetic energy of its molecules.
  - The average kinetic energy of the air molecules decreases, which in turn lowers the air temperature.
- 

**4 The troposphere is home to the most diverse forms of life on Earth.**

The diversity of life in the troposphere is due to the availability of:

- \* Essential gaseous components for life, such as oxygen, carbon dioxide, water vapor, and other gases.
  - \* A suitable temperature that supports the occurrence of biological processes.
  - \* An atmospheric pressure suitable for most living organisms.
- 

**5 The stratosphere is the preferred layer for aircraft flight.**

Because the air movements within it are horizontal.

---

**6 The temperature in the upper part of the stratosphere increases with altitude above 20 km from the Earth's surface.**

Due to the presence of the ozone layer.

---

**7 The mesosphere plays a vital role in protecting life on Earth.**

Because most meteors that enter the atmosphere from space burn up and disintegrate as they pass through this layer.

---

**8 The mesosphere is the coldest atmospheric layer.**

Due to the low number of gas molecules capable of absorbing solar radiation.

---

**9 The temperature in the thermosphere can rise above 2000°C.**

Because oxygen and nitrogen gases in this layer absorb most of the high-energy (high-frequency) solar radiation, such as X-rays and gamma rays.

---

**10 \* The lower part of the thermosphere is called the ionosphere.**

**\* The ionosphere is electrically charged.**

Because solar radiation ionizes the atoms of oxygen and nitrogen in this layer.



**11 \* The ionosphere is used for long-distance wireless communications.**

**\* The ability of ionosphere to reflect short radio waves.**

Because its high concentration of charged particles, that reflect short radio waves back to Earth.

**12 The planet Mercury has no atmosphere.**

Due to its weak gravity.

**13 Earth retains its atmosphere.**

Because its relatively strong gravity so that the effective velocity of most gas molecules is less than the planet's escape velocity.

**14 Avoiding the use of cleaning products that contain chlorine and bromine compounds.**

To reduce ozone layer depletion.

**15 Avoiding the use of fire extinguishers that contain halon gas.**

Because halon gas contains bromine which is considered one of the most powerful ozone depleting substances.

**16 \* Ozone gas that is found in the stratosphere is considered a shield that protects Earth from the harmful radiations, but it is considered harmful for the ecosystem when it is found in the troposphere.**

**\* Ozone has positive and negative impacts.**

As its existence in the stratosphere protects the Earth from the harmful ultraviolet radiation that threatens the life of living organisms, while its existence in the troposphere has several negative effects, including:

- Formation of smog.
- Affecting the growth and the quality of plants and agricultural crops.
- Corrosion of some substances, such as plastics and rubber.

**17 Ozone gas negatively affects the plants growth and their productivity when it is found in the troposphere.**

Because it can cause burn of plant leaves, which reduces their ability to perform photosynthesis process and damage of plants and agricultural crops that affects their growth and quality.



**18 Temperature is one of the most important climatic factors.**

Because changes in temperature affect atmospheric pressure, wind, humidity, condensation, and rainfall and all of these factors influence the climate.

**19 It is preferable to install an air conditioner high on a room's wall.**

Because it cools the air, increasing its density and causing it to sink so that warmer less dense air rises to take its place, allowing the cool air to circulate throughout the room more effectively.

**20 Air density is the highest within the first 30 km of the atmosphere.**

Because Earth's gravity pulls air molecules downward, concentrating most of the atmosphere's mass within this first 30 km of altitude. Therefore, the air has its highest density through this altitude.

**21 The values of atmospheric pressure and temperature are lower at the summit of a mountain than at its base.**

\* **Regarding atmospheric pressure:** As altitude increases, the weight of the air column above decreases, which causes the atmospheric pressure to decrease.

\* **Regarding temperature:**

- As altitude increases, the lower atmospheric pressure causes the air to expand and its molecules to spread apart, decreasing its density.
- The air draws the energy needed for this expansion from the kinetic energy of its molecules, which in turn lowers the temperature.

**22 Mountain climbers may suffer from the burst of blood capillaries in the nose.**

As altitude increases, the atmospheric pressure decreases. So, the difference between the blood pressure inside the blood capillaries and the atmospheric pressure increases, which can cause the bursting of blood capillaries in the nose.

**23 The body's production of red blood cells increases at high altitudes.**

Because the amount of available oxygen that the body can obtain decreases with increasing altitude.

**24 Red blood cells play an important role in transporting oxygen within the human body.**

Because their cytoplasm contains the red-colored pigment (hemoglobin), which is responsible for transporting oxygen and a little amount of  $\text{CO}_2$  within the human body.



**25 Platelets have an important role during bleeding.**

Because they participate in blood clotting during bleeding.

---

**26 White blood cells have an important role in protecting the body from diseases.**

Because they protect the body from bacteria, viruses, fungi and other foreign substances.

---

**27 It is important to maintain a normal blood pressure rate in human.**

To ensure the delivery of oxygen and nutrients to the tissues and for the overall health of the heart and blood vessels.

---

**28 The difference in atmospheric pressure is the cause of wind.**

Because wind is created by the horizontal movement of air from areas of high atmospheric pressure to areas of low atmospheric pressure.

---

**29 Parenchyma tissues have the ability to perform photosynthesis.**

Because they contain a large number of chloroplasts.

---

**30 \* The cells of sclerenchyma tissue are rigid and impermeable to water.  
\* Sclerenchyma tissue works to provide a significant mechanical strength to the plant.**

Because of their very thick cell walls made of cellulose and lignin.

---

**31 Humidity directly affects human comfort and health.**

Because it controls the body's efficiency in getting rid of excess heat through the process of sweating, as water absorbs the heat needed for its evaporation from the body, which works to regulate the blood temperature.

---

**32 The temperature of the air adjacent to the Earth's surface rises year after year.**

Due to global warming caused by the increase in the percentage of greenhouse gases in the atmosphere, as the atmosphere allows the passage of short-wavelength solar radiation towards the Earth, which is absorbed by the Earth and then re-emitted as a long-wavelength thermal radiation. So, the greenhouse gases prevent this radiation from passing into outer space.



**33 The disappearance of some coastal cities as a result of global warming phenomenon.**

Due to the melting of ice masses at the two poles, which leads to a rise in the water level in the seas and oceans.

---

**34 Afforestation is one of the most important methods to reduce global warming.**

Because the presence of the large amount of vegetation helps to improve air quality by increasing photosynthesis, which has a fundamental role in absorbing carbon dioxide gas, which is considered the main cause of the rise in Earth's temperature, i.e. the occurrence of global warming phenomenon.

---

**35 The oxygen supply to tissues decreases when exposed to carbon monoxide gas.**

Because the binding strength of carbon monoxide to hemoglobin is about 200 - 250 times greater than that of oxygen, which leads to the formation of the relatively stable carboxyhemoglobin compound (HbCO), which prevents oxygen from binding to hemoglobin.

---

**36 The accumulation of lactic acid and feeling fatigue and headache when exposed to carbon monoxide gas.**

Due to the formation of the carboxyhemoglobin compound, which leads to a decrease in the oxygen supply to tissues (Hypoxia), so the cells do not get enough oxygen that is required for cellular respiration. As a result, cells begin to rely on anaerobic respiration, leading to the accumulation of lactic acid and feeling fatigue and headache.

---

**37 Acid rain has a negative effect on the soil.**

As acid rain replaces essential salts (such as calcium and magnesium salts) from the soil, which leads to a decrease in the soil fertility.

---

**38 Meteorological monitoring stations around the world continuously measure various environmental and climatic changes.**

For early detection of air pollution or dangerous weather phenomena (such as dust storms or heat waves).

### 39 The recovery of some coral areas in the Great Barrier Reef in Australia after 2016

Preventive steps were taken, such as reducing the resulted pollution from coastal activities, and temporarily restrict fishing and tourism based on what climate monitoring centres predicted of a marine heat wave and a significant rise in ocean water temperature along the Great Barrier Reef in Australia, which reduced the extent of losses and helped some coral areas to recover.

## 10 What happens when ?

### 1 The absence of carbon dioxide gas from the atmosphere, "regarding plants and animals life".

Plants don't perform photosynthesis process, which leads to stopping their growth and their death, therefore there will be no source for food and oxygen for the animals, so they die.

### 2 The percentage of oxygen gas in the atmosphere increases, "regarding combustion processes".

The strength of combustion increases because oxygen gas is the active element in the combustion process.

### 3 Ascending upwards above sea level, "regarding air density".

Air density decreases because gravity pulls air molecules downward, concentrating most of the atmosphere's mass within the first 30 km above the Earth's surface.

### 4 Gas molecules on a planet moved at a speed equal to or greater than its escape velocity "regarding the possibility of escaping the planet's gravity".

The gas molecules would be able to escape the planet's gravity.

### 5 The atmospheric pressure between two regions at the same horizontal level on the Earth's surface differs "regarding the direction of the wind between them".

The wind would blow from the region of high atmospheric pressure to the region of low atmospheric pressure.



**6 A plant is devoid of parenchyma tissue.**

The plant will lose its ability to perform many vital functions such as photosynthesis, storing nutrients and water, secreting the sap and helping in ventilation.

---

**7 The absence of collenchyma tissue from the growing parts of a plant.**

These parts will lose their flexibility and elasticity.

---

**8 The absence of sclerenchyma tissue from a plant.**

The plant will lose a significant mechanical strength due to the loss of the rigidity of its cells.

---

**9 A plant is devoid of supportive tissues, "concerning the effect of wind on the plant".**

This may cause the breaking of plant stems or the tearing leaves.

---

**10 Lignin is deposited in the cell walls of collenchyma tissue.**

The collenchyma tissue will lose its vitality and its rigidity will increase.

---

**11 The humidity in air decreases, "regarding the rate of uptake of water and salts from the root to the leaves in plants".**

The rate of transpiration will increase, and consequently, the rate of uptake of water and salts from the root to the leaves will increase.

---

**12 The humidity in air increases, "regarding the efficiency of reducing the body temperature of animals".**

The efficiency of reducing the body temperature of animals decreases.

---

**13 The temperature decreases, "regarding the humidity of air".**

Air humidity decreases.

---

**14 The proportions of the gases that make up the atmosphere change.**

The effectiveness of the atmosphere in maintaining a suitable temperature for the life of living organisms will decrease, and its ability to protect the Earth from harmful solar radiation will also decrease.

**15 The levels of greenhouse gases in the atmosphere increases, "regarding the Earth's temperature".**

It leads to gradual increase in the temperature of the Earth's surface year after year, which threatens the occurrence of environmental disasters, such as melting of ice and extreme climate changes.

**16 The ice at the two poles melts due to the global warming phenomenon, "regarding the coastal cities and polar species".**

**This leads to:**

- (1) The flooding of coasts and the disappearance of some coastal cities.
- (2) The extinction of some polar species, due to the destruction of their natural habitats.

**17 Expanding in the use of the renewable energy, "regarding the average Earth's temperatures".**

The average Earth's temperatures decreases, due to the decrease in the percentage of greenhouse gases in the atmosphere.

**18 The incomplete combustion of fossil fuels.**

This leads to the production of some environmentally polluting gases such as carbon monoxide.

**19 A carbon monoxide molecule binds to the hemoglobin of red blood cells.**

The carboxyhemoglobin compound (HbCO) is formed, which prevents oxygen from binding to hemoglobin.

**20 The binding of oxygen to hemoglobin decreases.**

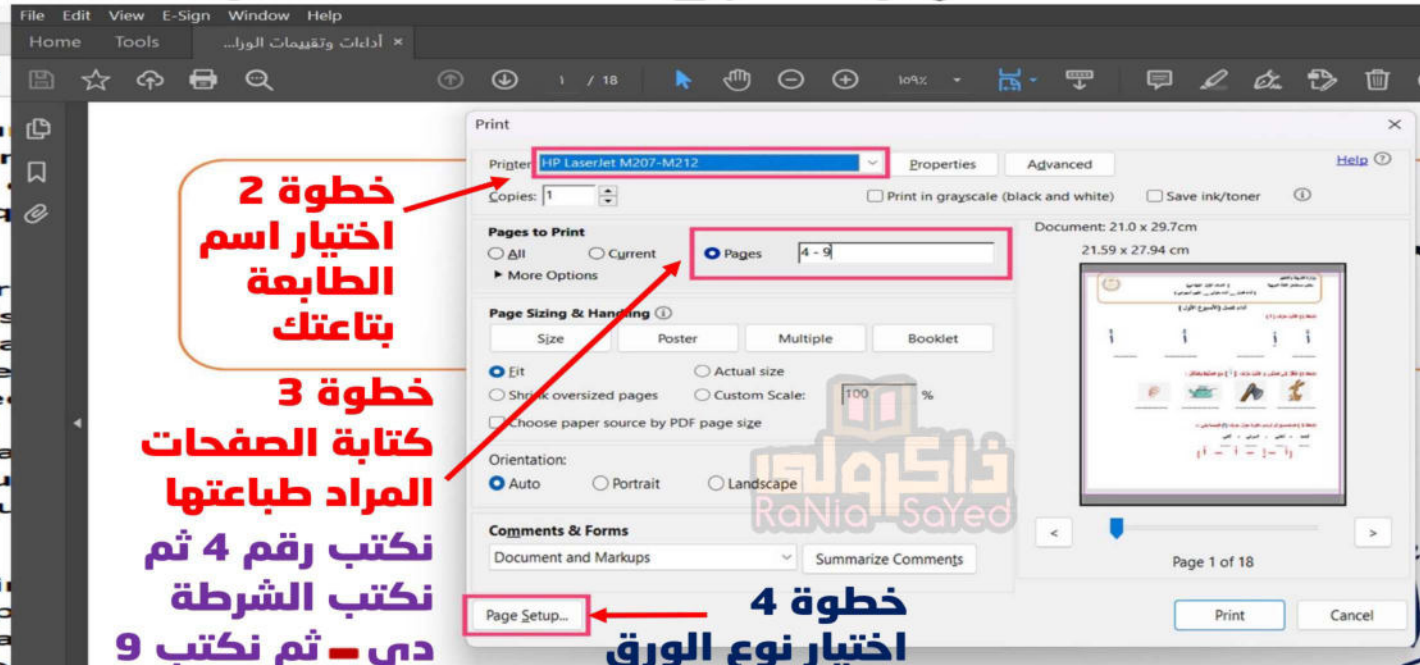
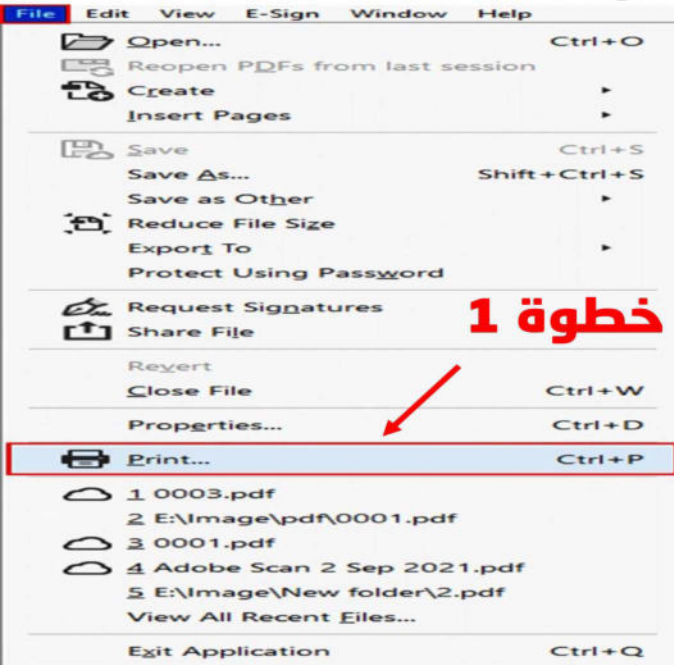
This leads to a decrease in the oxygen supply to the tissues (Hypoxia). Consequently, the cells will not get enough oxygen for cellular respiration, so the cells begin to rely on anaerobic respiration, which leads to the accumulation of lactic acid and feeling of fatigue and headache.

**21 The concentration of the (HbCO) compound in the blood increases.**

Serious symptoms such as dizziness, loss of consciousness and brain damage may occur.



# كيفية طباعة صفحات معينة من ملف معين مثلا ازاي نطبع الصفحات من صفحة 4 الى صفحة 9



حمل الآن

مجاناً وحصرياً

# المراجعة رقم (2)

## الترم الاول





## Exam

## 1



Answered

## Choose the correct answer (1 : 20):

- 1 A food chain includes predatory fish, algae, zooplankton and small fish. So, what happens after the predatory fish feed on small fish in great numbers?
- (a) Zooplankton increase and algae decrease. (b) Zooplankton decrease and algae increase.  
(c) Zooplankton and algae increase. (d) Zooplankton and algae decrease.

- 2 Which of the following correctly describes the wind between two regions and the atmospheric pressure at them?
- (a) The wind speed is high whenever the difference in atmospheric pressure between the two regions is small.  
(b) The wind speed is low whenever the difference in atmospheric pressure between the two regions is small.  
(c) Wind arises when the pressures are equal in the two regions.  
(d) There is no relation between the wind and the atmospheric pressure.

- 3 Ray fish can live in deep depths under high water pressure, because they have .....

|     | Liver that contains | Skeleton      |
|-----|---------------------|---------------|
| (a) | Low amount of oils  | Bony          |
| (b) | Low amount of oils  | Cartilaginous |
| (c) | High amount of oils | Bony          |
| (d) | High amount of oils | Cartilaginous |

- 4 A student has recorded statements about some of the atmosphere layers, as follows:

(I) It has the least temperature.

(II) In which most of the meteors that fall towards Earth are burnt up.

(III) It is used in wireless communications.

(IV) It is the preferable layer for aircraft flights.

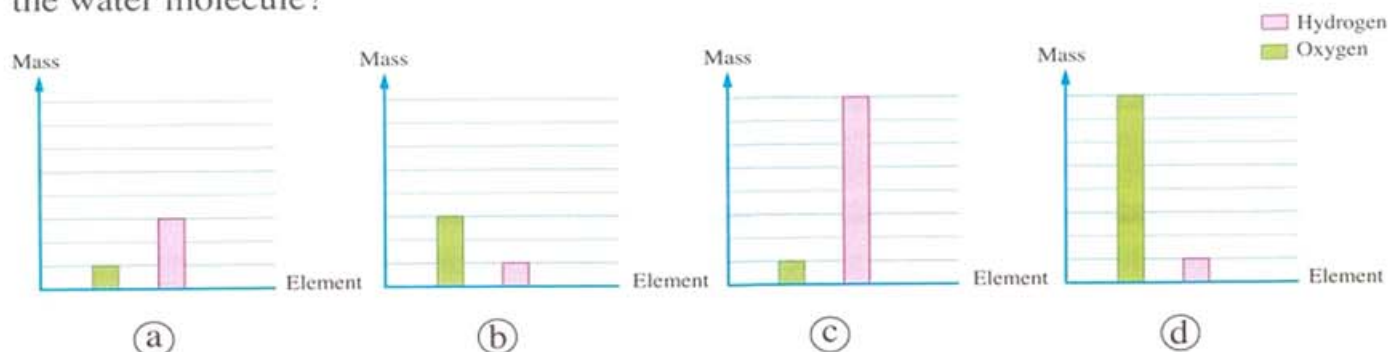
Which of the previous statements aircraft the mesosphere layer?

- (a) (I) and (III). (b) (II) and (IV).  
(c) (I) and (II). (d) (III) and (IV).

- 5 Marine organisms produce  $\text{CO}_2$  gas as a waste product resulted from ..... process.

- (a) transpiration (b) catabolism  
(c) photosynthesis (d) protein synthesis

- 6 Which of the following graphs represents the mass of each of hydrogen and oxygen in the water molecule?

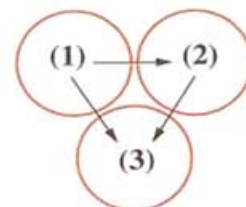


- 7 The opposite figure shows the molecular structure of one of the gases that exists in the atmosphere. What do you expect to happen to the rate of photosynthesis of plants on the Earth's surface when getting exposed to huge amounts of this gas?



- (a) Increases. (b) Decreases.  
(c) Not affected. (d) The answer can't be determined.

- 8 The opposite figure represents the direction of water transfer by osmosis among three adjacent living cells. Which of the following represents the correct arrangement of cells from the least to the highest water concentration?



- (a) (2) → (1) → (3). (b) (2) → (3) → (1).  
(c) (1) → (2) → (3). (d) (3) → (2) → (1).

- 9 When water vapor condenses, the temperature of the surrounding air .....

- (a) increases, as water vapor absorbs heat energy  
(b) increases, as water vapor releases heat energy  
(c) decreases, as water vapor absorbs heat energy  
(d) decreases, as water vapor releases heat energy

- 10 Which of the following leads to a decrease in pH value of the rainwater if its percentage increases?

- (a)  $\text{CaCO}_3$  (b)  $\text{H}_2\text{O}$  (c)  $\text{NaCl}$  (d)  $\text{H}_2\text{SO}_4$

- 11 What is the correct order of the stages that a quantity of seawater goes through in order to return to seas again?

- (a) Evaporation → Condensation → Rainfall → Runoff.  
(b) Rainfall → Runoff → Evaporation → Condensation.  
(c) Runoff → Evaporation → Condensation → Rainfall.  
(d) Condensation → Rainfall → Runoff → Evaporation.



**12** The Earth retains its atmosphere, while the Mercury planet doesn't have an atmosphere, and this is because .....

- (a) the Earth's gravity is stronger
- (b) the Earth's gravity is weaker
- (c) the temperatures on the Earth's surface are higher
- (d) the Earth has a biosphere

**13** In the following are statements for a student about the effect of solar radiation on aquatic environments:

- (I) Autotrophic organisms are found in abundance in the deep depths.
- (II) Living organisms in water of polar regions are negatively affected in winter due to the lack of food availability.
- (III) Coral reefs thrive in warm, shallow water.

Which of these statements are correct?

- (a) (I) and (II).
- (b) (II) and (III).
- (c) (I) and (III).
- (d) The three statements are correct.

**14** Which of the following living organisms belongs to mollusks?

- (a) Shrimp.
- (b) Coral.
- (c) Ray.
- (d) Clam.

**15** An amount of water of mass 1 kg at a temperature  $10^{\circ}\text{C}$  has lost an amount of heat of 37800 J through an interval of time ( $t_0$ ), if you know that the specific heat of water is  $4200 \text{ J/kg.K}$ , then the density of water through that period ( $t_0$ ) .....

- (a) decreases continuously
- (b) decreases then increases
- (c) increases continuously
- (d) increases then decreases

**16** What happens to the volume of a quantity of pure water when its temperature is raised from  $33^{\circ}\text{F}$  to  $39^{\circ}\text{F}$ ?

- (a) It increases.
- (b) It decreases.
- (c) It decreases, then increases.
- (d) It does not change.

**17** The opposite figure shows the settling position of an egg placed in a quantity of fresh water, when a large quantity of table salt is dissolved in water, then the egg .....

- (a) rises
- (b) sinks
- (c) remains in its position
- (d) the answer can't be determined



- 18** Which of the following represents the correct arrangement for the boiling points of the following solutions that have equal concentrations at the standard atmospheric pressure?
- (a)  $\text{NaCl} < \text{MgCl}_2 < \text{Al}_2(\text{SO}_4)_3$  (b)  $\text{NaCl} < \text{Al}_2(\text{SO}_4)_3 < \text{MgCl}_2$   
(c)  $\text{Al}_2(\text{SO}_4)_3 < \text{MgCl}_2 < \text{NaCl}$  (d)  $\text{Al}_2(\text{SO}_4)_3 < \text{NaCl} < \text{MgCl}_2$

- 19** What is the probable result for increasing the temperature of an aquatic environment on the organisms that live in it?
- (a) The difficulty of respiration. (b) Increasing the photosynthesis process rate.  
(c) Decreasing the calcification rate. (d) Increasing the living organisms activity.

- 20** Which of the following keep the liquidity of cell membranes and their stability to withstand high pressure in deep-depths fish?
- (a) Proteins. (b) Carbohydrates.  
(c) Saturated fatty acids. (d) Unsaturated fatty acids

### Answer the following questions (21 & 22):

- 21** Viperfish is considered as an example for the structural and physiological adaptations. **Explain this.**

.....  
.....

- 22** **Mention** an example for the negative impact on the human body, due to losing a large amount of water from his body, and **how** can the body protect itself from that?

.....  
.....

## Exam 2 ? Answered

### Choose the correct answer (1 : 20):

- 1** Which of the following **isn't** from the excretory substances in animals?
- (a)  $\text{CO}_2$  gas. (b) Water vapor. (c)  $\text{O}_2$  gas. (d) Urea.
- 2** Which of the following **isn't** from the cold-blooded organisms?
- (a) Fish. (b) Amphibians. (c) Reptiles. (d) Birds.
- 3** Deep-ocean fish develop certain adaptations in their cell membranes to adapt with ..... through ..... the levels of unsaturated fatty acids.
- (a) decreased light intensity / increasing (b) decreased light intensity / decreasing  
(c) increased pressure / increasing (d) increased pressure / decreasing



4 Which of the following salts its ions remain in the solution without forming bonds with water molecules?

- (a) Sodium carbonate. (b) Sodium bicarbonate.  
(c) Sodium chloride. (d) Ammonium chloride.

5 Which of the following components play(s) the essential role in blood clotting during bleeding?

- (a) Platelets. (b) Red blood cells. (c) White blood cells. (d) Plasma.

6 Which of the following living organisms doesn't have contractile vacuole?

- (a) *Amoeba*. (b) *Paramecium*. (c) Shark fish. (d) *Euglena*.

7 If the solubility of carbon dioxide gas in the aquatic environment (X) is more than its solubility in the aquatic environment (Y). Which of the following is the reason for that?

|     | Aquatic environment (X)         | Aquatic environment (Y)        |
|-----|---------------------------------|--------------------------------|
| (a) | The water temperature is higher | The water temperature is lower |
| (b) | Freshwater                      | Saltwater                      |
| (c) | Water is stable                 | Water is turbulent             |
| (d) | The low number of dead fish     | The high number of dead fish   |

8 Which of the following gases contributes to the formation of smog?

- (a) Oxygen. (b) Sulphur dioxide. (c) Nitrogen. (d) Argon.

9 The farthest atmospheric layer from the Earth's surface is .....

- (a) troposphere (b) mesosphere (c) thermosphere (d) exosphere

10 Which of the following enhances the ecological balance in the aquatic ecosystem?

- (a) Reducing the metabolic rate of living organisms.  
(b) Reducing the interaction among living organisms' species.  
(c) Increasing the acidification process in water.  
(d) Increasing the photosynthesis rate of phytoplankton.

11 How far are these statements correct "the plant cell walls contain cellulose", "all the plant cells can perform photosynthesis process"?

- (a) The two statements are correct.  
(b) The first statement is correct and the second statement is wrong.  
(c) The first statement is wrong the second statement is correct.  
(d) The two statements are wrong.

- 12** In houses, heaters are placed on the floor of a room, because when their surrounding air heats up, it ..... .  
(a) rises up because it is denser than cold air  
(b) rises up because it is less dense than cold air  
(c) settles at the same level because it is denser than cold air  
(d) settles at the same level because it is less dense than cold air
- 13** If the temperatures at the base and the top of Cairo Tower are  $30^{\circ}\text{C}$  and  $28.8^{\circ}\text{C}$  respectively, then the height of the tower is approximately equal to ..... .  
(a) 334 m                      (b) 279 m                      (c) 185 m                      (d) 180 m
- 14** The amount of heat required to raise a certain amount of a liquid from a certain temperature to its boiling point at sea level relative to that at the top of a mountain is ..... .  
(a) greater than one    (b) less than one    (c) equal to one                      (d) unpredictable
- 15** A thin slide is suspended at a constant depth inside water placed in a container, so the force exerted by the water on the slide is greater, when ..... .  
(a) the mass of the slide is great  
(b) the mass of the slide is small  
(c) the surface area of the slide is large  
(d) the surface area of the slide is small
- 16** Which of the following is considered a physiological adaptation for deep-ocean fish?  
(a) The compressed body.                      (b) The strong arteries and veins.  
(c) Modification of blood pressure.                      (d) The large-sized gills.
- 17** The breakdown of glucose molecules occurs in the living cells through a biological process called ..... .  
(a) excretion                      (b) catabolism  
(c) anabolism                      (d) growth
- 18** In which of the following plant tissues lignin enters in their cell walls structure?  
(a) Parenchyma tissue.                      (b) Sclerenchyma tissue.  
(c) Collenchyma and xylem tissues.                      (d) Parenchyma and collenchyma tissues.
- 19** An amount of water of mass  $m$  is poured in a container, then another amount of water of mass  $m$  is added to it at the same temperature, then the specific heat of water ..... .  
(a) is doubled                      (b) is tripled  
(c) doesn't change                      (d) is halved



- 20** Three glass vessels, each of them contains the same volume of a different liquid, a hydrometer was used to measure the density of the three liquids, so its position at equilibrium was as shown in the following figures, then the correct order of these figures according to the mass of the liquid in each vessel is .....

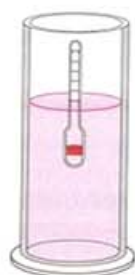


Figure (1)

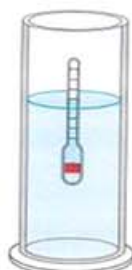


Figure (2)

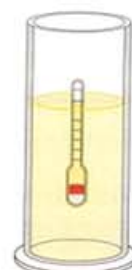


Figure (3)

- (a)  $(3) > (2) > (1)$   
 (b)  $(2) > (3) > (1)$   
 (c)  $(1) > (2) > (3)$   
 (d)  $(1) > (3) > (2)$

### Answer the following questions (21 : 23):

- 21** Egypt resorts to construct many power generating stations by using solar panels. Show the importance of this, according to your study of the concept of sustainability.

.....  
 .....

- 22** The following table shows the colors of one of the prepared indicators from the flowers of a plant:

| Color | Red |   |   | Purple |   |   | Blue |   | Greenish-blue |    | Yellowish-green |    |
|-------|-----|---|---|--------|---|---|------|---|---------------|----|-----------------|----|
| pH    | 1   | 2 | 3 | 4      | 5 | 6 | 7    | 8 | 9             | 10 | 11              | 12 |

What is the formed color when adding drops of this indicator to ammonium bicarbonate solution?

.....  
 .....

- 23** Gulf stream is considered an example of the effect of the solar radiation on water currents in the Atlantic Ocean. Explain this.

.....  
 .....

## Exam 3

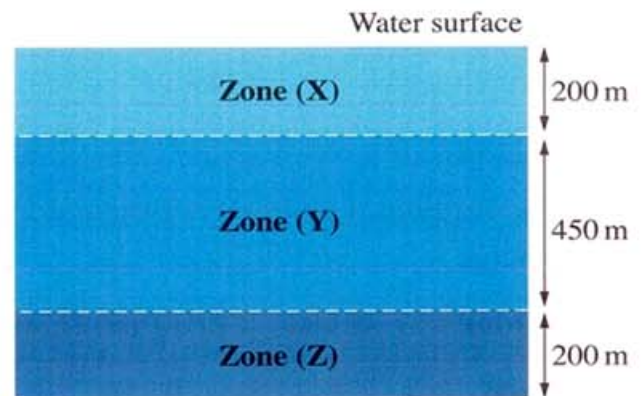


Answered

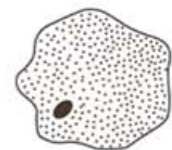
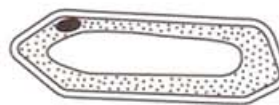
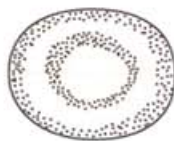
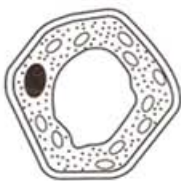
### Choose the correct answer (1 : 20):

- 1 When the temperature of a body changes from 50°F to 280 K, the internal energy of the body .....
- (a) decreases (b) increases  
(c) doesn't change (d) the answer can't be determined
- 2 In the following, the specifications of four water samples, each of mass 1 kg. Two samples are of saltwater with the same concentration and two samples are of freshwater, which of these samples has the highest density?
- (a) Saltwater sample at 4°C. (b) Freshwater sample at 4°C.  
(c) Saltwater sample at 8°C. (d) Freshwater sample at 8°C.

- 3 The opposite figure represents three zones (X), (Y) and (Z) in the ocean water, which of these zones is the most suitable for the existence of autotrophic algae in it?
- (a) Zone (X).  
(b) Zone (Y).  
(c) Zone (Z).  
(d) The three zones are of the same probability.



- 4 Which of the following is/are present in all the illustrated cells?

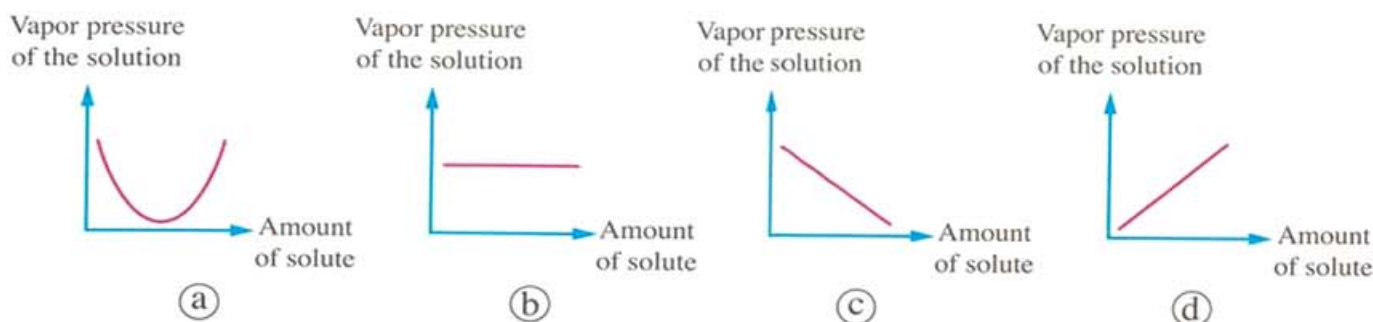


- (a) Cell membrane. (b) Cell wall. (c) Plastids. (d) Nucleus.

- 5 When sodium bicarbonate solution is added to a cylinder containing an amount of ammonium chloride, then the pH value of the contents of the cylinder .....
- (a) decreases (b) increases  
(c) remains constant (d) unpredictable



- 6 Which of the following graphs represents the relation between the vapor pressure of the solution and the amount of solute at temperature ( $T = 25^{\circ}\text{C}$ )?



- 7 Which of the following is **not** from the structural adaptations of dolphins?

- (a) Streamlined shape. (b) The presence of fins.  
(c) The presence of breathing openings. (d) Large-sized eyes.

- 8 When the nutrients excessively increase in the aquatic system, this leads to .....

- (a) decreasing the growth rate of plants (b) increasing the biodiversity  
(c) abnormal algal blooming (d) the stability of the ecosystem

- 9 Which of the following statements is correct about the adaptation of shark fish with water pressure?

- (a) It has air bladder, which helps it to control its buoyancy.  
(b) It has air bladder, which helps it to regulate its temperature.  
(c) It has bony skeleton, which provides a strong support for its body.  
(d) It has cartilaginous skeleton, which gives it the required flexibility.

- 10 Which of the following arrangements correctly describes the order of forming sulphuric acid rain?

- (a)  $\text{SO}_2 \longrightarrow \text{H}_2\text{SO}_4 \longrightarrow \text{SO}_3$  (b)  $\text{SO}_2 \longrightarrow \text{SO}_3 \longrightarrow \text{H}_2\text{SO}_4$   
(c)  $\text{SO}_3 \longrightarrow \text{SO}_2 \longrightarrow \text{H}_2\text{SO}_4$  (d)  $\text{H}_2\text{SO}_4 \longrightarrow \text{SO}_2 \longrightarrow \text{SO}_3$

- 11 Water in the liquid state contains .....

- (a) covalent bonds only (b) hydrogen bonds only  
(c) covalent and hydrogen bonds (d) ionic and hydrogen bonds

- 12 Two identical quantities (1) and (2) of the same gas, if the temperature of quantity (1) is greater than that of quantity (2). So, the ratio between the effective velocity of the two quantities molecules  $\left( \frac{(v_{\text{rms}})_1}{(v_{\text{rms}})_2} \right)$  is .....

- (a) greater than 1 (b) less than 1 (c) equal to 1 (d) indeterminable

**13** When moving a barometer from the foot of a mountain to its top, the amount of mercury in the basin .....

- (a) decreases
- (b) increases
- (c) doesn't change
- (d) the answer can't be determined

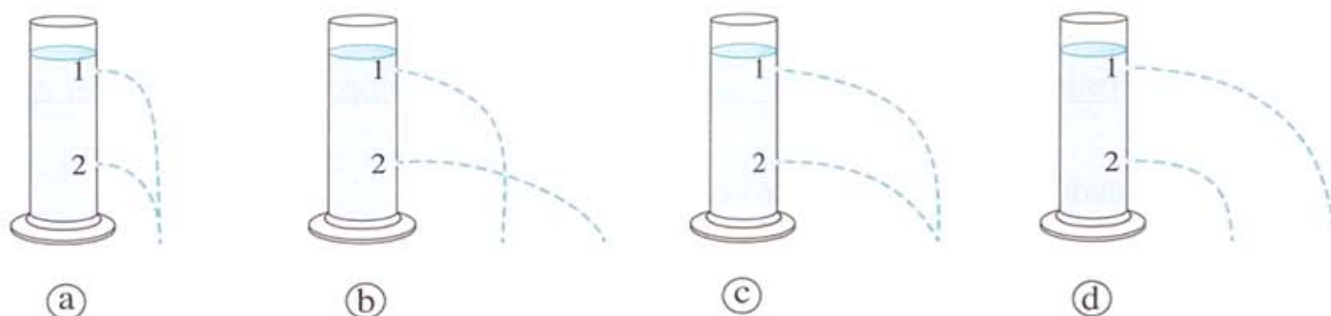
**14** The two processes in which the physical state of water is similar immediately after their occurrence are .....

- (a) evaporation and condensation
- (b) condensation and transpiration
- (c) transpiration and evaporation
- (d) condensation and freezing

**15** Which of the following layers has the least thickness?

- (a) Ozone layer.
- (b) Tropopause layer.
- (c) Ionosphere layer.
- (d) All three layers have equal thickness.

**16** Which of the following figures represents the correct path of the water getting out from the two openings ① and ② of a vessel containing water?



**17** In the life cycle of salmon fish, which of the following stages live all of its life in an aquatic environment of a low osmotic pressure?

- (a) Eggs only.
- (b) Adult salmon only.
- (c) Eggs and young salmon.
- (d) Young and adult salmon.

**18** Which of the following is from the reasons of global warming phenomenon?

- (a) Fossil fuel combustion.
- (b) Increasing the rate of photosynthesis.
- (c) Animals overhunting.
- (d) Industrial wastewater treatment.

**19** A body has a mass of 70 kg, a temperature of 98.6°F and a specific heat of 3400 J/kg.K, the required amount of heat that is gained by the body to raise its temperature to 102.2°F equals .....

- (a)  $8.6 \times 10^5$  J
- (b)  $4.8 \times 10^5$  J
- (c)  $4.3 \times 10^5$  J
- (d)  $2.4 \times 10^5$  J



**20** What is the effect of lens absorption to UV rays on the light transmittance to retina?

- (a) The light transmittance increases.
- (b) The light transmittance decreases.
- (c) It doesn't affect the light transmittance.
- (d) It may increase or decrease the light transmittance.

### Answer the following questions (21 & 22):

**21** Compare between: wood frog, icefish and thorny devil lizard, "according to: the way of adaptation with the temperature of the environment where they live".

.....

.....

**22** The following diagram represents an aquatic food chain:



**What** is the effect of decreasing the level of the dissolved carbon dioxide gas in water on the energy flow through this chain?

.....

.....

.....

## Exam 4



Answered

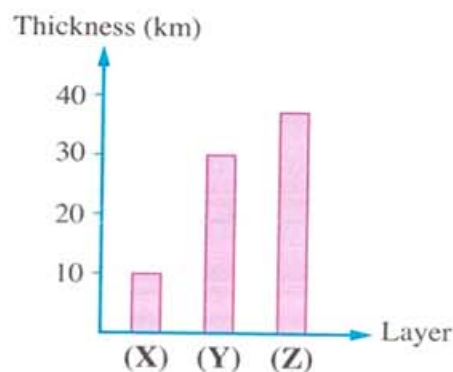
### Choose the correct answer (1 : 20):

**1** How many hydrogen atoms are involved in forming 6 hydrogen bonds between a number of water molecules?

- (a) 6
- (b) 12
- (c) 18
- (d) 24

**2** The opposite figure represents the average thickness of the three closest layers of the atmosphere to the Earth's surface, in which of these layers does ozone gas have a harmful effect on the living organisms?

- (a) Layer (X).
- (b) Layer (Y).
- (c) Layer (Z).
- (d) Layers (Z) and (Y).



3 Which of the following is **not** a characteristic of the environment?

- (a) A whole system whose components cannot be separated.
- (b) Includes biotic and abiotic components.
- (c) Influenced by a set of variables surrounding its components.
- (d) Consists of six interconnected spheres.

4 A salty solution of mass 1 kg and volume  $9.8 \times 10^{-4} \text{ m}^3$ , so its relative density equals .....

(Where: the density of water =  $1000 \text{ kg/m}^3$ )

- (a) 0.98
- (b) 1
- (c) 1.02
- (d) 1.04

5 The opposite figure represents four regions of electromagnetic spectrum, which of the following represents the regions of spectrum (A) and spectrum (B) respectively?

|   |   |                 |               |
|---|---|-----------------|---------------|
| B | A | Ultraviolet ray | Visible light |
|---|---|-----------------|---------------|

- (a) Radio waves, Infrared rays.
- (b) X-rays, Gamma rays.
- (c) Infrared rays, Radio waves.
- (d) Gamma rays, X-rays.

6 If you know that the air temperature in a certain area on the Earth's surface is  $10.72^\circ\text{C}$ , then the temperature at the top of a mountain with a height of 880 m in this area equals .....

- (a) 373 K
- (b)  $1^\circ\text{C}$
- (c)  $41^\circ\text{F}$
- (d)  $5^\circ\text{F}$

7 Which of the following organs in the body of Nile tilapia fish help(s) it to float?

- (a) Kidneys.
- (b) Skin.
- (c) Gills.
- (d) Air bladder.

8 One of the reasons why polar bear is at the risk of extinction is .....

- (a) the increase in the ice cap
- (b) the extreme cold at the North pole
- (c) the destruction of its original habitat
- (d) both (a) and (b)

9 The pH values of different solutions range from .....

- (a) 0 to 7
- (b) 7 to 14
- (c) 0 to 14
- (d) 7 to 10

10 Which of the following enzymes is highly specific?



(a)



(b)



(c)



(d)



- 11 In the following figures, the heat is transferred either from the hand or to it,



Figure (1)



Figure (2)

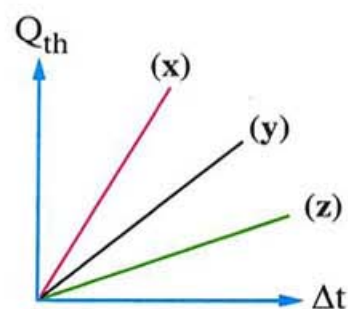


Figure (3)

In which figure is the heat transferred by conduction to the hand?

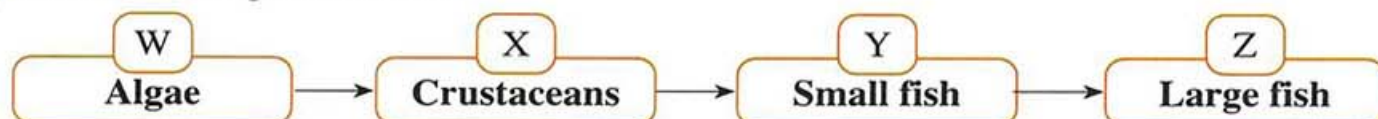
- (a) In figure (1). (b) In figure (2). (c) In figure (3). (d) In all figures.

- 12 The opposite graph represents the relation between the amount of heat ( $Q_{th}$ ) that is gained by three equal masses of different substances (x), (y) and (z), and the change in temperature ( $\Delta t$ ) for each of them. So, the correct arrangement of the specific heat for the three substances is .....



- (a)  $c_z > c_y > c_x$  (b)  $c_x > c_y > c_z$   
(c)  $c_x > c_z > c_y$  (d)  $c_x = c_y = c_z$

- 13 In the following food chain:



All the following are considered from the reasons for the occurrence of an imbalance in this food chain, **except** .....

- (a) increasing the number of (W) and (X)  
(b) the predation of (Z) to (Y) by great numbers  
(c) increasing the number of (X)  
(d) the overfishing of (Z)

- 14 What happens to the transpiration rate in the plant, when the humidity level decreases in the atmosphere at the same temperature?

- (a) Increases. (b) Decreases.  
(c) Doesn't change. (d) The answer can't be determined.

- 15 Which of the following is considered an example for the behavioral adaptation in living organisms?

- (a) Sweat secretion in human. (b) Strong claws of raptors.  
(c) The hibernation of tortoises. (d) The monkeys with long arms.

- 16** Although the solubility of  $\text{CO}_2$  in water is higher than the solubility of  $\text{O}_2$  in water, the percentage of  $\text{O}_2$  gas in water exceeds the percentage of  $\text{CO}_2$  in some aquatic environments. So, which of the following may be the reason for that?
- (a) The abundance of phytoplankton. (b) Increasing the industrial waste.  
(c) Increasing the number of dead fish. (d) Increasing the respiration rate of fish.

- 17** The following figure shows the molecular structure of two compounds, as hydrogen bonds are found among the molecules of compound (1), while being absent among the molecules of compound (2) despite their similarity in structure. What is the reason for that?



- (a) The difference in the electronegativity between atoms (X) and (H) is higher.  
(b) The difference in the electronegativity between atoms (Y) and (H) is higher.  
(c) Molecule (1) is non-polar, while molecule (2) is polar.  
(d) The electronegativity of atom (X) is higher than that of atom (Y).
- 18** What is the effect of acid rain on the agricultural soil?
- (a) Reducing nutrients. (b) Decreasing soil humidity.  
(c) Decreasing temperature. (d) Increasing soil fertility.
- 19** Four thin slides (X), (Y), (Z) and (K) with areas  $A$ ,  $2A$ ,  $A$ ,  $2A$  respectively are suspended inside a container of water at a depth of  $h$ ,  $h$ ,  $2h$ ,  $2h$  from water surface respectively. Which of these slides is affected by the greater pressing force?
- (a) Slide (X). (b) Slide (Y). (c) Slide (Z). (d) Slide (K).
- 20** A sea breeze is .....
- (a) the warm air moving from the water surface to the land  
(b) the warm air moving from the land toward the sea  
(c) the cold air moving from the water surface to the land  
(d) the cold air moving from the land toward the sea

### Answer the following questions (21 : 23):

- 21** Why is the aurora phenomenon observed specifically at the Earth's North and South Poles?

.....  
.....



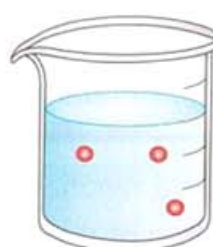
- 22** The following figures express 4 identical beakers, each of them contains a solution of different concentration for the same non-volatile solute at the same temperature. So, if the circles refer to the dissolved substance.



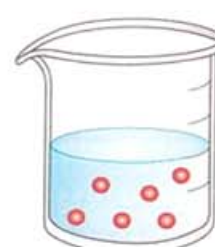
A



B



C



D

**Which** of these solutions has the highest boiling point? **Explain your answer.**

- 23** If the pressure of an enclosed gas is 1520 mm Hg, **calculate** its pressure in the unit of bars.

## Exam 5 ? Answered

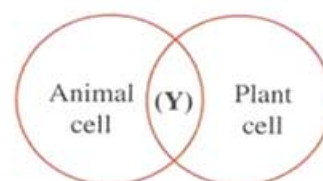
### Choose the correct answer (1 : 20):

- 1** All of the following occur when the relative humidity in air increases, **except** .....

- (a) a decrease in the rate of transpiration in the plant
- (b) an increase in the efficiency of the animal's body to lower its temperature
- (c) a decrease in the rate of lifting water and salts from the root to leaves in plants
- (d) a decrease in sweat evaporation rate in animals

- 2** In the opposite diagram, which of the following represents (Y) that expresses a common structure between the two cells?

- (a) Plasma membrane.    (b) Chloroplast.
- (c) Cell wall.                (d) Large vacuoles.



- 3** The solubility of a gas in solution can be measured from the relation .....

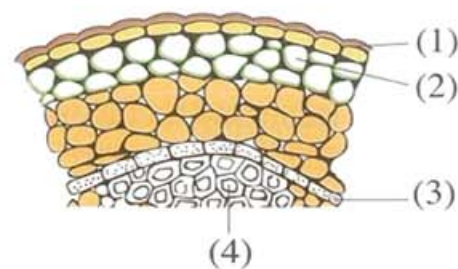
- (a) mass of the dissolved gas  $\times$  volume of the solution
- (b)  $\frac{\text{mass of the dissolved gas}}{\text{volume of the solution}}$
- (c) mass of the dissolved gas  $-$  volume of the solution
- (d) mass of the dissolved gas  $+$  volume of the solution

- 4** Which of the following is greater for pure water molecules at 1°C than at 4°C?
- (a) Vibration amplitude.
  - (b) Speed.
  - (c) Mass.
  - (d) Intermolecular spaces.
- 
- 5** Decreasing the percentage of CO<sub>2</sub> in water leads to .....
- (a) increasing the rate of photosynthesis process
  - (b) reducing water acidity
  - (c) increasing energy that reaches predators
  - (d) reducing the pH value of water
- 
- 6** Which of the following is an example for the structural adaptation in aquatic living organisms?
- (a) Salmon migration for reproduction.
  - (b) Increased respiration efficiency of deep-sea fish.
  - (c) Swim bladder in some fish.
  - (d) Venom secretion in some fish.
- 
- 7** In the hydrological cycle, water can return to the sea through .....
- (a) condensation or evaporation
  - (b) condensation or runoff
  - (c) evaporation or rainfall
  - (d) rainfall or runoff
- 
- 8** Which of the following is from the uses of climate models?
- (a) Measuring the concentration of greenhouse gases.
  - (b) Measuring wind speed.
  - (c) Tracking the recovery of the ozone layer.
  - (d) Forecasting changing rainfall patterns.
- 
- 9** Producing sounds by whales to communicate is considered .....
- (a) structural adaptation only
  - (b) behavioral adaptation only
  - (c) structural and physiological adaptations
  - (d) behavioral and functional adaptations
- 
- 10** The pH value of pure water increases when ..... is dissolved in it.
- (a) carbon dioxide gas
  - (b) ammonium bicarbonate salt
  - (c) ammonium chloride salt
  - (d) sodium bicarbonate salt
- 
- 11** The following are the steps for the formation of ozone gas in the stratosphere:
- (I) A single oxygen atom binds with an oxygen molecule.
  - (II) The covalent bond between the two oxygen atoms in the oxygen molecule is broken down.
  - (III) Short-wavelength ultraviolet radiation falls on an oxygen molecule.
- The correct order for these steps is .....
- (a) I → II → III
  - (b) III → II → I
  - (c) III → I → II
  - (d) I → III → II



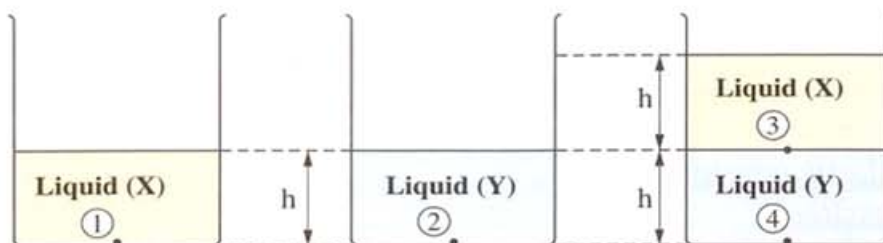
- 12** What is the probable effect of global warming on seas and oceans?  
 (a) Reducing biodiversity in seas. (b) Decrease in sea level.  
 (c) Decrease in water temperature. (d) Regression of ocean water.
- 
- 13** If the latent heat of vaporization of water is equal to (E), then in order for a quantity of water with a mass of 5 kg to change from the liquid state at 100°C to the gaseous state at 100°C, it must .....  
 (a) absorb (E) of thermal energy  
 (b) absorb (5E) of thermal energy  
 (c) release (E) of thermal energy  
 (d) release (5E) of thermal energy
- 
- 14** Which of the following choices is not from the environmental protection practices?  
 (a) Reliance on renewable energy.  
 (b) Reducing plastic consumption.  
 (c) Urban expansion.  
 (d) Reducing coal usage.
- 
- 15** The dissolution of a solid salt in water producing an acid and a base one or both is/are weak, is known as .....  
 (a) solubility  
 (b) hydrolysis of salts  
 (c) acid-base balance.  
 (d) diffusion
- 
- 16** If the boiling point of a liquid is X°C at sea level and becomes Y°C on the top of a mountain, which of the following expresses the ratio  $\frac{X}{Y}$ ?  
 (a) It is greater than one.  
 (b) It is equal to one.  
 (c) It is less than one.  
 (d) It is equal to zero.
- 
- 17** Which of the following types of matter takes the shape of its container while maintaining a constant volume?  
 (a) Solids. (b) Liquids.  
 (c) Gases. (d) All matter.
- 
- 18** A piece of aluminum of mass 0.025 kg and temperature 100°C was thrown in an amount of water of mass 0.064 kg and temperature (t) in Celsius. So, the system final temperature became 40°C. If you know that the specific heat of water and aluminum respectively are 4200 J/kg.K and 897 J/kg.K. Assuming that there is no thermal leakage from the system, then the water temperature (t) before throwing the aluminum piece in it equals .....  
 (a) 5°C (b) 25°C (c) 35°C (d) 40°C

- 19 The opposite figure represents a group of plant tissues in a stem of a higher plant, what is the tissue whose cell walls consist of cellulose and pectin?



- (a) (1). (b) (2).  
(c) (3). (d) (4).

- 20 Three containers, each containing a quantity of liquid or two immiscible liquids are represented by the following figures:



So, the correct order of pressures at points ①, ②, ③ and ④ that are shown in the figures is .....

- (a)  $P_4 > P_3 = P_2 > P_1$  (b)  $P_4 > P_3 > P_2 = P_1$   
(c)  $P_4 > P_2 > P_1 = P_3$  (d)  $P_4 = P_2 = P_1 > P_3$

### Answer the following questions (21 & 22):

- 21 Explain:

(a) Increasing the number of red blood cells for people who live in mountaintops.

.....  
.....

(b) Algae and phytoplankton are abundant in the surficial layers of water bodies.

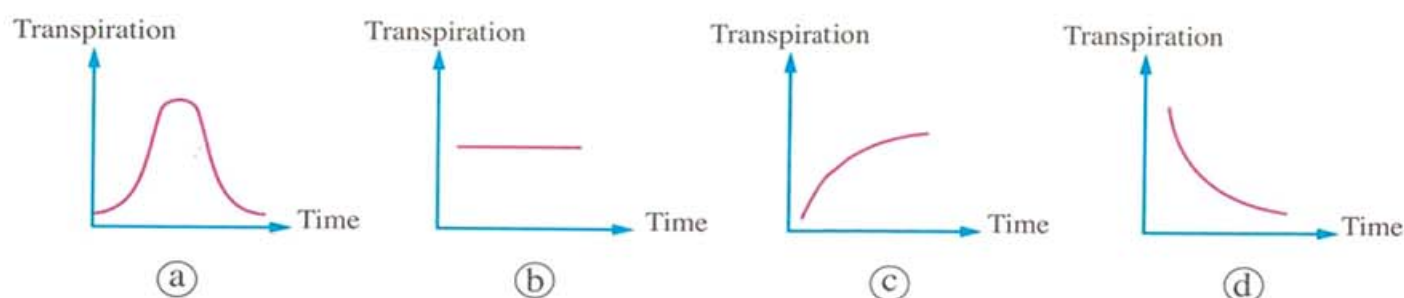
.....  
.....

- 22 "The percentages of the atmospheric components are changing through various natural processes". How far is this statement correct? Support your answer with an example.

.....  
.....



**1** Which of the following graphs illustrates the relation between the transpiration and time of a plant over a whole day?



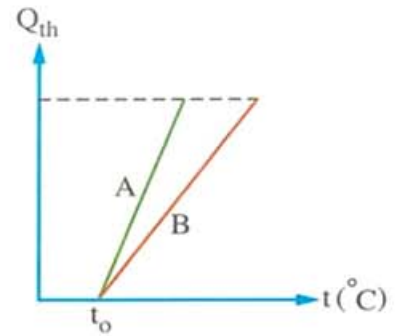
- 2** The ratio between the concentration of ( $\text{H}^+$ ) ions in an acidic solution to their concentration in an alkaline solution .....
- (a) is greater than 1  
(b) is equal to 1  
(c) is less than 1  
(d) the answer can't be determined

- 3** Which of the following statements isn't applied to blood?
- (a) It is a specialized connective tissue.
  - (b) It consists of intercellular substance called plasma.
  - (c) It consists of four major types of cells.
  - (d) It plays an important role in transporting nutrients and protecting the body against infection.

- 4** Increasing the percentage of  $\text{CO}_2$  in water leads to .....
- (a) increasing the acidity of water
  - (b) reducing the energy produced by aquatic plants
  - (c) reducing the energy that reaches predators
  - (d) increasing the pH value of water

- 5** Which chemical substance does shark fish keep in its blood to help in regulating its osmotic pressure?
- (a) Water. (b) Oxygen.
- (c) Urea. (d) Carbon.

- 6 Two quantities of two liquids A and B with the same mass were heated from a temperature  $t_0$  and the opposite graph represents the relation between the amount of heat ( $Q_{th}$ ) absorbed by each liquid and its temperature ( $t$ ), so which liquid has a higher specific heat?

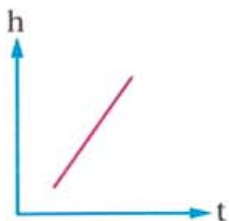


- (a) Liquid A.
- (b) Liquid B.
- (c) The two liquids have the same specific heat.
- (d) The answer cannot be determined.

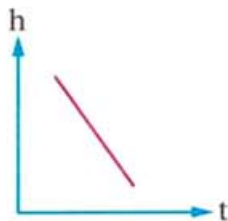
- 7 Gulf stream is ..... oceanic current that flows towards Western Europe and it .....

- (a) cold – enhances marine biodiversity
- (b) warm – reduces marine biodiversity
- (c) warm – enhances marine biodiversity
- (d) cold – reduces marine biodiversity

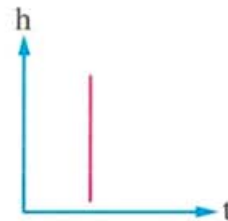
- 8 Which of the following graphs represents the relation between the altitude ( $h$ ) above the Earth's surface and the air temperature ( $t$ ) in troposphere layer?



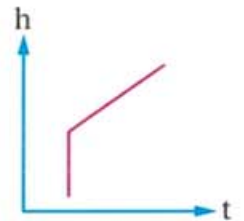
(a)



(b)



(c)



(d)

- 9 As the concentration of dissolved substances in water increases, all of the following are correct, **except** .....

- (a) the vapor pressure decreases
- (b) the freezing point decreases
- (c) the osmotic pressure increases
- (d) the boiling point decreases

- 10 The type of chemical bonds of water in its vapor state is .....

- (a) hydrogen bonds
- (b) double covalent bonds
- (c) single covalent bonds
- (d) both covalent and hydrogen bonds

- 11 Nitrogen gas represents 78% of .....

- (a) the mass of the atmosphere
- (b) the weight of the atmosphere
- (c) the volume of the atmosphere
- (d) the mass and weight of the atmosphere

- 12 At which of the following temperatures does pure water exist in its liquid state under normal conditions?

- (a) 4°F
- (b) 25°F
- (c) 122°F
- (d) 300°F



- 13** How does the thorny devil lizard adapt to the high temperatures and dry environment of the desert?
- (a) It changes the color of its skin to reflect more sunlight and reduce the heat absorption.
  - (b) It increases its heartbeats rate to increase the blood flow to the skin to cool it.
  - (c) It collects moisture from the air and directs it to its mouth through small channels on the surface of its skin.
  - (d) It stores small amounts of fats to cool its body.
- 14** At one stage of ozone formation, an oxygen molecule undergoes photodissociation, where the bond of the molecule is broken as a result of .....
- (a) emission of visible light photons
  - (b) emission of ultraviolet photons
  - (c) absorption of visible light photons
  - (d) absorption of ultraviolet photons
- 15** What happens to the area of ice cap on Earth as a result of global warming?
- (a) Increases.
  - (b) Decreases.
  - (c) Doesn't change.
  - (d) The answer can't be determined.
- 16** What is the most active organelle during practicing physical activities?
- (a) Vacuole.
  - (b) Endoplasmic reticulum.
  - (c) Mitochondrion.
  - (d) Nucleus.
- 17** The ratio between the solubility of carbon dioxide gas to the solubility of oxygen gas in water .....
- (a) is greater than 1
  - (b) is less than 1
  - (c) is equal to 1
  - (d) the answer can't be determined
- 18** Which of the following is **not** from the effects of gas oxides and acid rain?
- (a) Deformation of plant stomata.
  - (b) Increased soil fertility.
  - (c) Reduction of respiratory capacity.
  - (d) Corrosion of historic buildings.
- 19** Which of the following is correct about viperfish?
- (a) It exists in polar regions.
  - (b) It has an air bladder.
  - (c) It has high levels of haemoglobin.
  - (d) It has breathing openings.
- 20** How does the over consumption of small fish affect the aquatic ecosystem?
- (a) It participates in improving the aquatic plants growth.
  - (b) It leads to a disturbance in the numbers of zooplankton.
  - (c) It improves the energy balance among living organisms.
  - (d) It increases the water quality due to decreased pollution.

### Answer the following questions (21 & 22):

- 21** Mention one of the reasons for the formation of ocean currents, and **what** is the importance of these currents?

.....  
.....

- 22** Mention two biological adaptations for the aquatic organisms that live at deep-depths to adapt with the high pressure in these depths.

.....  
.....

## Exam

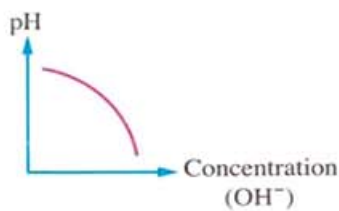
## 7



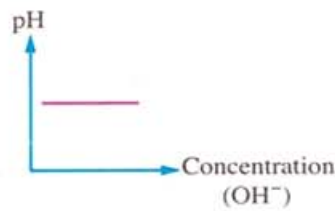
Answered

### Choose the correct answer (1 : 20):

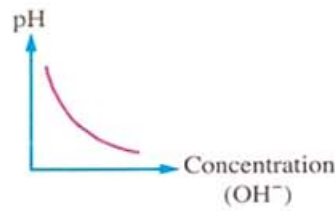
- 1** Which of the following graphs expresses the relation between the pH value and the concentration of  $(OH^-)$  ions?



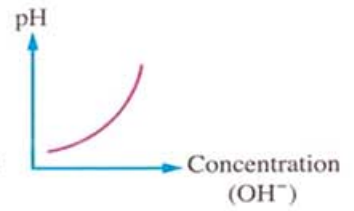
(a)



(b)



(c)



(d)

- 2** A quantity of pure water has a volume of  $1 \text{ m}^3$  at a temperature of  $4^\circ\text{C}$ , its temperature dropped to the freezing point, then the volume of this quantity when it turns into ice with a density of  $917 \text{ kg/m}^3$  is approximately equal to .....

(a)  $1.03 \text{ m}^3$

(b)  $1.05 \text{ m}^3$

(c)  $1.09 \text{ m}^3$

(d)  $1.04 \text{ m}^3$

- 3** Which of the following statements is correct about collenchyma tissue?

(a) It is composed of non-living rigid cells.

(b) It provides some strength in addition to elasticity and flexibility to the plant.

(c) It forms most of the soft tissues in the plant.

(d) Its cell walls consist of cellulose and lignin.

- 4** The ratio between the osmotic pressure of fresh water to the osmotic pressure of body fluids inside fish that live in this water is .....

(a) greater than 1

(b) equal to 1

(c) less than 1

(d) the answer can't be determined



- 5 A beaker contains 220 g of water as shown in figure (1). If the specific heat of water is  $4200 \text{ J/kg.K}$ , so the amount of heat required to raise the temperature of water to be as shown in figure (2) is .....

(a) 55440 J (b) 81900 J  
(c) 44550 J (d) 95550 J

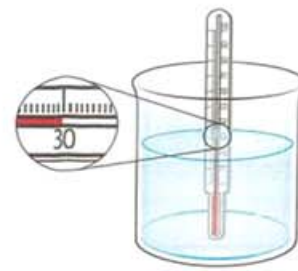


Figure (1)

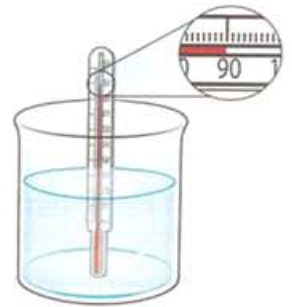


Figure (2)

- 6 Two beams of solar radiation of equal intensity are incident on the surface of water, one is inclined and the other is perpendicular, as shown in the opposite figures, so the light energy that penetrates the surface will be .....

(a) greater in figure (1) (b) greater in figure (2)  
(c) equal in the two figures (d) zero in the two figures

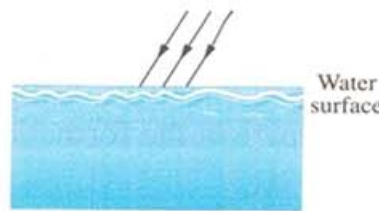


Figure (1)

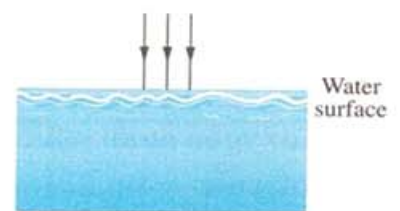


Figure (2)

- 7 A fish with a body surface area of  $0.1 \text{ m}^2$  is at a depth of 5 m from the water surface, then the pressing force acting on the body of the fish is equal to .....  
(Knowing that:  $1 \text{ atm} = 1.013 \times 10^5 \text{ N/m}^2$ )

(a)  $10^3 \text{ N}$  (b)  $5.1 \times 10^3 \text{ N}$   
(c)  $1.5 \times 10^4 \text{ N}$  (d)  $2.5 \times 10^4 \text{ N}$

- 8 If the boiling point of a liquid at the top of a mountain is  $110^\circ\text{C}$ , then the boiling point of the same liquid at the Earth's surface could be .....

(a) higher than 383 K (b) equal to 383 K  
(c) less than 383 K (d) the answer can't be determined

- 9 Which of the following are always exist in the second trophic level of the food chain?

(a) Plants. (b) Lions. (c) Rabbits. (d) Fungi.

- 10 If the atmospheric pressure at the top of the stratosphere is  $P_1$ , the atmospheric pressure at the top of the troposphere is  $P_2$ , and at the top of the mesosphere is  $P_3$ , which of the following relations is correct?

(a)  $P_2 > P_1 > P_3$  (b)  $P_1 > P_2 > P_3$   
(c)  $P_3 > P_1 > P_2$  (d)  $P_3 > P_2 > P_1$

- 11 Polar winds are cold and ..... and they blow from areas with ..... atmospheric pressure around polar regions.

(a) wet - low (b) dry - low (c) warm - high (d) dry - high

**12** What is the purpose of using renewable energy sources?

- (a) Reducing the use of fossil fuel.
- (b) Reducing daily energy consumption.
- (c) Increasing greenhouse gas emissions.
- (d) Increasing the frequency of extreme weather phenomena.

**13** The ratio of the area occupied by water to the area of land on the Earth's surface is equal to .....

- (a)  $\frac{3}{7}$
- (b)  $\frac{7}{10}$
- (c)  $\frac{3}{10}$
- (d)  $\frac{7}{3}$

**14** The ratio between the number of electrons of hydrogen atom to the number of electrons of oxygen atom which participate in the formation of single covalent bond in a water molecule .....

- (a) 1 : 1
- (b) 2 : 1
- (c) 1 : 2
- (d) 8 : 1

**15** The following figure illustrates the mechanism of the enzyme action:



What does each of (W), (X) and (Y) represent in this chemical reaction?

|     | Enzyme | Products | Substrate |
|-----|--------|----------|-----------|
| (a) | W      | X        | Y         |
| (b) | X      | W        | Y         |
| (c) | X      | Y        | W         |
| (d) | Y      | W        | X         |

**16** Which of the following organisms has/have breathing openings?

- (a) Dolphins.
- (b) Salmon.
- (c) Icefish.
- (d) Viperfish.

**17** The following are statements written by a student about the factors on which the density of a body substance depends:

- (I) The mass of the body.
- (II) The mass of the body molecules.
- (III) The volume of the body.
- (IV) The distances between its molecules (intermolecular spaces).

On which of these factors does the density of a body substance depend?

- (a) (I) and (III).
- (b) (II) and (IV).
- (c) (I) and (IV).
- (d) (II) and (III).



**18** The presence of a certain gas in abundance in a planet's atmosphere means that the effective velocity of the molecules of that gas compared to the escape velocity from the planet is .....

- (a) less (b) equal  
(c) slightly greater (d) much greater

**19** Which of the following gases, when inhaled, results in the formation of carboxyhaemoglobin in the blood?

- (a)  $\text{CO}_2$  (b)  $\text{NO}_2$  (c)  $\text{CO}$  (d)  $\text{SO}_3$

**20** Which of the following living organisms represent an example for adaptation to low temperatures?

- (a) Wood frog and thorny devil lizard.  
(b) Icefish and tilapia.  
(c) Wood frog and icefish.  
(d) Icefish and thorny devil lizard.

### Answer the following questions (21 & 22):

**21** What is meant by gas solubility? **Identify** the factors affecting it.

.....  
.....

**22** Mention a use of ultraviolet rays in:

- (a) The medical field.  
(b) The field of counterfeit banknotes.

.....  
.....

**Exam 8**



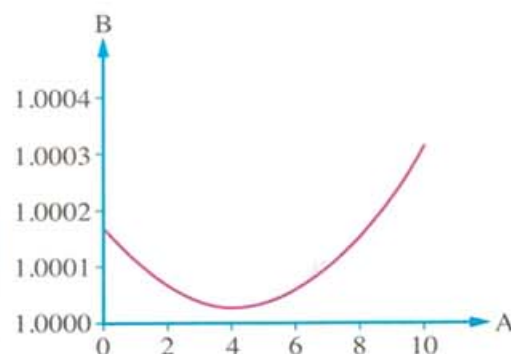
Answered

### Choose the correct answer (1 : 20):

**1** Which of the following are considered from the major elements in the formation of carbohydrates during the photosynthesis process?

- (a) Glucose and carbon dioxide. (b) Oxygen and glucose.  
(c) Carbon dioxide and water. (d) Water and oxygen.

- 2 The opposite graph expresses the relation between two variables (A) and (B) for a transparent liquid that has the ability to dissolve many compounds. Which of the following expresses the variables (A) and (B)?



|     | Variable (A) | Variable (B) |
|-----|--------------|--------------|
| (a) | Density      | Mass         |
| (b) | Density      | Volume       |
| (c) | Temperature  | Density      |
| (d) | Temperature  | Volume       |

- 3 Increasing urea concentration inside the shark's body acts on .....

- (a) increasing the osmotic pressure and decreasing water loss
- (b) increasing both the osmotic pressure and water loss
- (c) decreasing both the osmotic pressure and water loss
- (d) decreasing the osmotic pressure and increasing water loss

- 4 A body of mass 2 kg has a temperature of  $27^{\circ}\text{C}$ , and the specific heat capacity of its material is  $2 \times 10^3 \text{ J/kg.K}$ . If it gains an amount of heat equal to  $10^4 \text{ J}$ , the temperature of the body will .....

- (a) increase to 325 K
- (b) increase to  $325^{\circ}\text{C}$
- (c) increase by 2.5 K
- (d) increase by 5 K

- 5 Which of the two types of the electromagnetic spectrum, infrared rays or visible light, gets completely absorbed by water first?

- (a) Infrared rays.
- (b) Visible light.
- (c) Both are completely absorbed at the same depth.
- (d) Neither is absorbed at all.

- 6 If the depth of the water in a lake is 40 m, then the pressure caused by the water at the bottom is approximately .....

- (a) 3 times the atmospheric pressure
- (b) 4 times the atmospheric pressure
- (c) 5 times the atmospheric pressure
- (d) 6 times the atmospheric pressure

- 7 Two solutions (X) and (Y) of the same salt, if the freezing point of the solution (X) is lower than the freezing point of the solution (Y), then .....

- (a) the concentration of salt in solution (X) is higher
- (b) the concentration of salt in solution (Y) is higher
- (c) the concentration of solution (X) is low
- (d) the concentration of the two solutions is equal



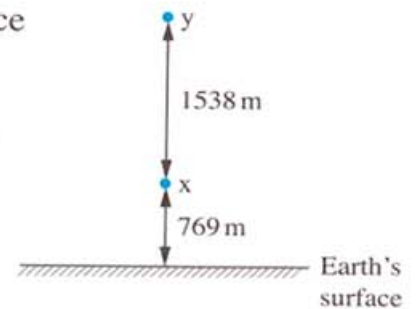
8 Mountain climbers may suffer from bursting of tiny capillaries in the nose due to .....

- (a) low temperature
- (b) a large difference between the blood pressure inside them and the external atmospheric pressure.
- (c) increased physical activity
- (d) high oxygen levels

9 When the temperature of the environment surrounding warm-blooded organisms changes, their body temperature ..... and from their examples are .....

- (a) changes - birds
- (b) changes - most fish
- (c) remains constant - birds
- (d) remains constant - most fish

10 In the opposite figure, if the air temperature at the Earth's surface is  $20^{\circ}\text{C}$ , then the ratio between the air temperatures at the two points (y) and (x) on the Celsius scale ( $\frac{t_y}{t_x}$ ) is equal to.....



- (a)  $\frac{1}{3}$
- (b)  $\frac{1}{4}$
- (c)  $\frac{2}{5}$
- (d)  $\frac{5}{2}$

11 How is the growth rate of fish affected by an increase in dissolved carbon dioxide in water?

- (a) Increases.
- (b) Decreases.
- (c) Is not affected.
- (d) Stops.

12 The ratio between the molecular mass of water to the molecular mass of hydrogen sulphide is .....

- (a) greater than 1
- (b) less than 1
- (c) equal to 1
- (d) the answer can't be determined

13 Which of the following leads to coral bleaching?

- (a) Decrease in sea urchin populations.
- (b) Increase in the number of predatory fish.
- (c) Increase in water temperature.
- (d) Increase in the number of symbiotic algae.

14 The large eyes in icefish is considered ..... adaptation.

- (a) behavioral
- (b) functional
- (c) physiological
- (d) structural

**15** Which of the following fish has an air bladder? And what is its role?

- (a) Ray fish / Helping in regulating its body temperature.
- (b) Ray fish / Helping in transport between different depths.
- (c) Salmon fish / Helping in regulating its body temperature.
- (d) Salmon fish / Helping in transporting between different depths.

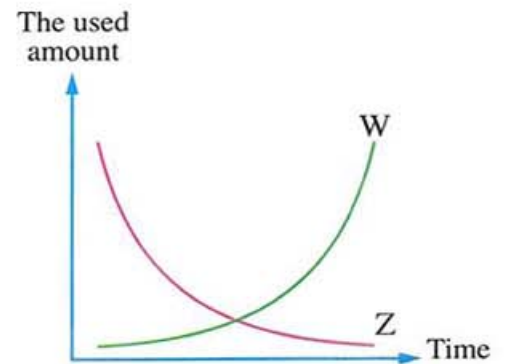
**16** Which of the following keeps the internal temperature of the aquatic cold-blooded organisms?

- (a) The high specific heat of water.
- (b) The presence of saturated fatty acids in the cell membranes.
- (c) The presence of single covalent bonds in water molecules.
- (d) The presence of multiple vacuoles in the animal cells.

**17** From the examples of greenhouse gases that cause global warming is .....

- (a) CO
- (b) O<sub>2</sub>
- (c) H<sub>2</sub>
- (d) N<sub>2</sub>O

**18** In the opposite graph, curve (W) indicates the amount of solar energy used and curve (Z) indicates the amount of fossil fuel used in a certain region. What conclusion can you deduce from this graph?



- (a) Increasing air pollution.
- (b) Climate change and rising temperature.
- (c) Threat to biodiversity.
- (d) Improve the quality of life.

**19** You have four living organisms (freshwater algae - shark fish - cactus plant - forest lions), which of the following is applied to these organisms?

- (a) Food chain.
- (b) Food web.
- (c) Living in different ecosystems.
- (d) Living in one environment.

**20** Which of the following represents the correct arrangement of the following solutions regarding the pH value?

- (a) Ammonium bicarbonate < Ammonium chloride < Sodium bicarbonate
- (b) Ammonium chloride < Ammonium bicarbonate < Sodium bicarbonate
- (c) Ammonium bicarbonate < Sodium bicarbonate < Ammonium chloride
- (d) Sodium bicarbonate < Ammonium chloride < Ammonium bicarbonate



**Answer the following questions (21 & 22):**

**21** Mention two procedures that aim to limit the depletion of ozone layer and **support your answer by practical examples.**

**22 Explain:** The Earth retains its gaseous atmosphere.

## Exam

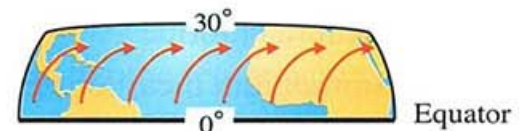
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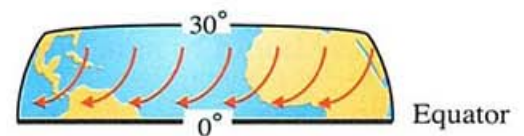
**Answered**

**Choose the correct answer (1 : 20):**

- 1** Which of the two opposite figures, (1) or (2), correctly represents the direction of the wind between the equator and latitude  $30^\circ$ ?
- (a) Figure (1), because the atmospheric pressure is high at the equator.
  - (b) Figure (1), because the atmospheric pressure is low at the equator.
  - (c) Figure (2), because the atmospheric pressure is high at the equator.
  - (d) Figure (2), because the atmospheric pressure is low at the equator.



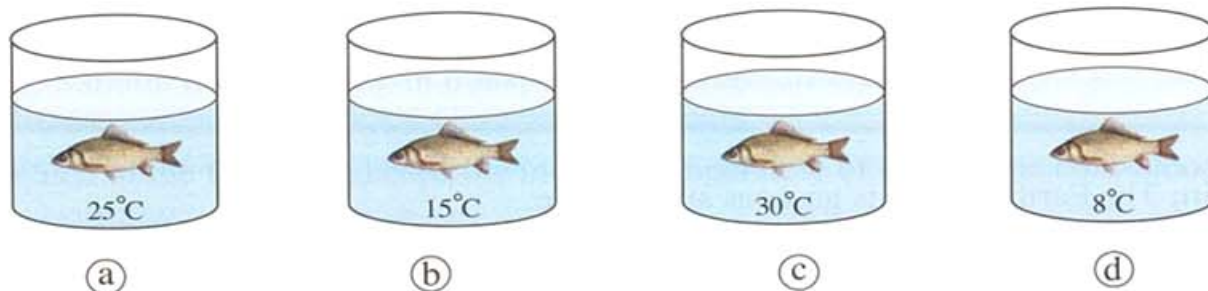
**Figure (1)**



**Figure (2)**

- 2 All of the following can produce sulphur dioxide gas, **except** ..... .
- (a) oil refining (b) lightning  
(c) oil combustion (d) metals melting
- 
- 3 Which of the following processes increases the percentage of water vapor in the atmosphere?
- (a) Infiltration. (b) Condensation. (c) Precipitation. (d) Transpiration.
- 
- 4 At great depths in the oceans ..... .
- (a) water pressure decreases and its density increases  
(b) water pressure increases and its density decreases  
(c) both water pressure and its density increase  
(d) both water pressure and its density decrease

- 5 The following figures represent four basins containing equal amounts of fresh water at different temperatures. Which of these basins has the least active organism?



- 6 Some marine organisms depend on the deposition of ..... substance to form their shells or bony skeletons.

(a) collagen (b) chitin  
(c) calcium carbonate (d) calcium phosphate

- 7 Water can dissolve and hydrolyze the following salts, **except** .....

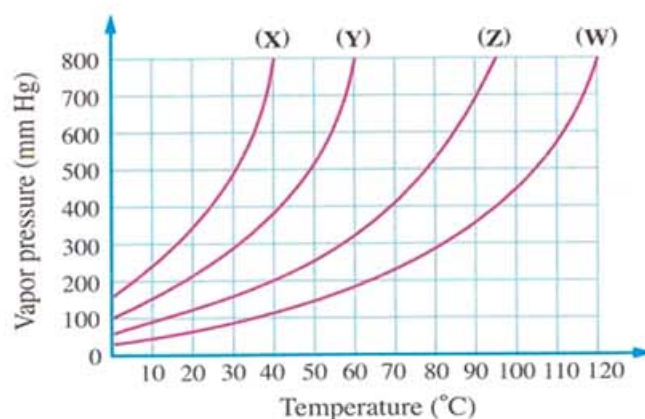
(a) sodium chloride (b) sodium bicarbonate  
(c) ammonium bicarbonate (d) ammonium chloride

- 8 A fish at depth 10 m of the water surface whose air bladder volume measured at this depth was  $50 \text{ cm}^3$ , then it moved to become at depth 30 m. So, the volume of its air bladder is about .....

(a)  $70 \text{ cm}^3$  (b)  $80 \text{ cm}^3$  (c)  $50 \text{ cm}^3$  (d)  $25 \text{ cm}^3$

- 9 The opposite graph expresses the relation between the vapor pressure of four pure liquids (X), (Y), (Z) and (W) at different temperatures, which liquid whose boiling point is the least at standard atmospheric pressure?

(a) (X).  
(b) (Y).  
(c) (Z).  
(d) (W).



- 10 Which of the following mainly contributes to smog formation in troposphere?

(a) Oxygen in the presence of sunlight. (b) Nitrogen in the absence of sunlight.  
(c) Ozone and sulphur dioxide. (d) Argon and fine particles.



- 11 Autotrophic aquatic organisms are found in abundance in ..... .
- (a) surface areas, due to the increase in the amount of solar radiation
  - (b) surface areas, due to the decrease in the amount of solar radiation
  - (c) deep areas, due to the increase in the amount of solar radiation
  - (d) deep areas, due to the decrease in the amount of solar radiation

- 12 The opposite figure represents two spheres, one made of iron and the other of aluminum, under the conditions shown in the figure. Which of the following is correct?



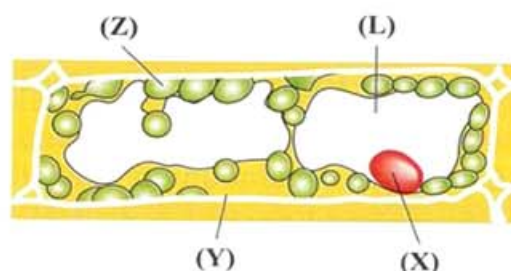
|     | Direction of heat transfer | Method of heat transfer |
|-----|----------------------------|-------------------------|
| (a) | From iron to aluminum      | Convection              |
| (b) | From aluminum to iron      | Conduction              |
| (c) | From iron to aluminum      | Radiation               |
| (d) | From aluminum to iron      | Convection              |

- 13 All of the following pairs of compounds contribute to increasing the temperature of the air adjacent to the Earth's surface, **except** ..... .
- (a) CH<sub>4</sub>, CO<sub>2</sub>
  - (b) CFCs, H<sub>2</sub>O
  - (c) NH<sub>3</sub>, NO<sub>2</sub>
  - (d) N<sub>2</sub>O, CH<sub>4</sub>

- 14 The force that is exerted by blood during its circulation on unit area of blood vessels walls is called ..... .
- (a) systolic pressure
  - (b) diastolic pressure
  - (c) blood pressure
  - (d) blood flow rate

- 15 Which region of the ultraviolet spectrum, when an oxygen molecule absorbs its photons, can break the chemical bond of the molecule?
- (a) Region (UVA).
  - (b) Region (UVB).
  - (c) Region (UVC).
  - (d) The three regions.

- 16 The opposite figure illustrates a cell of a living organism that lives in pond water and fresh swamps. Which of the following indicate(s) that it is a plant cell?
- (a) (Y) only.
  - (b) (Z) only.
  - (c) (X) and (L).
  - (d) (Y) and (L).



- 17** Which of the atmospheric layers is used for wireless communications, and in which of them does the polar aurora phenomenon occur?

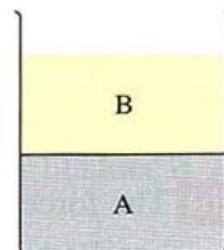
|     | Wireless communications | Aurora       |
|-----|-------------------------|--------------|
| (a) | Ionosphere              | Troposphere  |
| (b) | Exosphere               | Stratosphere |
| (c) | Troposphere             | Ionosphere   |
| (d) | Ionosphere              | Ionosphere   |

- 18** Which of the following solutions, when mixed together in equal proportions of volume and concentration, gives a solution with a pH value less than 7?

- (a) Carbonic acid, sodium hydroxide.
- (b) Hydrochloric acid, sodium hydroxide.
- (c) Hydrochloric acid, ammonium hydroxide.
- (d) Ammonium bicarbonate, sodium bicarbonate.

- 19** The opposite figure shows a container with two liquids, (A) and (B). If the volume of liquid (A) is  $10 \text{ cm}^3$  and its mass is 12 g, which of the following values could be the density of liquid (B)?

- (a)  $0.8 \text{ g/cm}^3$
- (b)  $1.8 \text{ g/cm}^3$
- (c)  $3.1 \text{ g/cm}^3$
- (d)  $13.6 \text{ g/cm}^3$



- 20** Which of the following impacts is considered as a direct result of overfishing of marine animals?

- (a) The increase of predatory fish numbers.
- (b) The imbalance of marine ecosystem.
- (c) The increase of marine biodiversity.
- (d) Enhancement of the quality of water, due to the reduction of fish numbers.

### Answer the following questions (21 & 22):

- 21** Calculate the amount of heat energy required to raise the temperature of 50 g of copper from  $20^\circ\text{C}$  to  $80^\circ\text{C}$ .

(Given that: The specific heat of copper =  $385 \text{ J/kg.K}$ )

.....  
 .....



**22 Identify:**

- (a) Type of adaptation in salmon migration.  
 (b) Functional suitability of the contractile vacuole in *Amoeba*.
- .....  
 .....

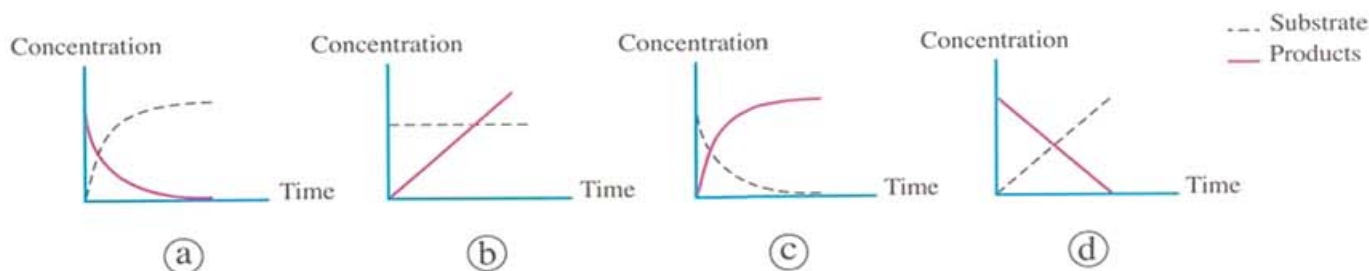
**Exam 10 ? Answered****Choose the correct answer (1 : 20):**

- 1** If the amount of dissolved oxygen in one liter of river water at a temperature of 20°C is about 10 mg, what is its potential amount in one liter of ocean water at the same temperature?  
 (a) 7.5 mg                      (b) 12 mg                      (c) 15 mg                      (d) 10 mg
- 2** The higher we move up to the surface of the sea compared to the sea floor, then .....

|     | Pressure at a point | The percentage of dissolved oxygen |
|-----|---------------------|------------------------------------|
| (a) | Increases           | Increases                          |
| (b) | Decreases           | Increases                          |
| (c) | Increases           | Decreases                          |
| (d) | Decreases           | Decreases                          |

- 3** The ratio of the altitude at which an airplane is flying and experiencing an atmospheric pressure of 110 millibars to the altitude at which an airplane is flying and experiencing an atmospheric pressure of 80 millibars is .....  
 (a) greater than one                      (b) less than one  
 (c) equal to one                      (d) cannot be determined
- 4** The environment is a whole system that consists of ..... elements.  
 (a) physical only                      (b) chemical only  
 (c) chemical and biological                      (d) physical, chemical, and biological
- 5** The compressed body of the icfish body is considered ..... adaptation.  
 (a) physiological                      (b) structural                      (c) behavioral                      (d) functional

- 6 From the following graphs, which relation shows the change in the concentration of substrate with the quantity of products over time of the reaction in optimum conditions?



- 7 Which of the following gases causes corrosion of plastic and rubber?  
 (a) Argon. (b) Nitrogen. (c) Oxygen. (d) Ozone.

- 8 Viperfish adapts with low levels of oxygen in depths by .....

- (a) the presence of high levels of haemoglobin in its blood  
 (b) the presence of flexible bony skeleton  
 (c) the increase of metabolic rate  
 (d) the presence of strong arteries and veins

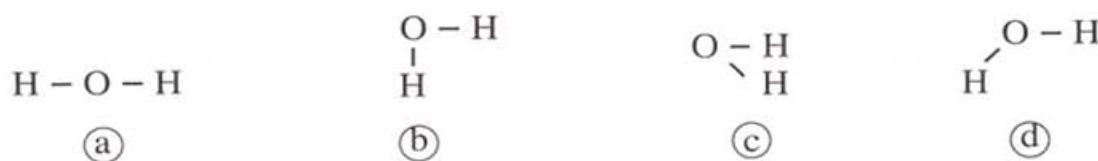
- 9 Which of the following wavelengths of ultraviolet rays causes the breaking of the covalent bond in an oxygen molecule upon absorption?

- (a) 200 nm (b) 300 nm (c) 350 nm (d) 550 nm

- 10 If we assume that gas (X) is one of the main gases in the planet Earth's atmosphere, which of the following can represent the value of effective velocity ( $v_{rms}$ ) for this gas?

- (a) 11.2 km/s (b) 12.2 km/s (c) 9.2 km/s (d) 19.2 km/s

- 11 Which of the following figures correctly expresses the structure of water molecule and the angle between the two covalent bonds?



- 12 Which of the following has an important role in energy production in the form of ATP molecules?

- (a) Nitrogen. (b) Carbon. (c) Calcium. (d) Oxygen.

- 13 Which of the following is **not** from the functions of satellites?

- (a) Removing sulphur oxides from the atmospheric air.  
 (b) Measuring the concentration of gases responsible for global warming.  
 (c) Continuously monitoring the state of the ozone layer.  
 (d) Providing meteorologists with data on cloud movement.

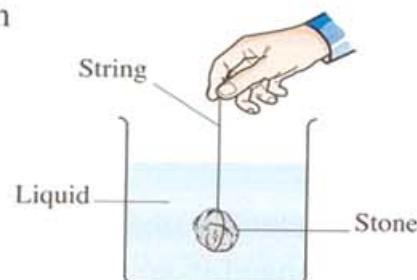


**14** When a quantity of table salt is dissolved in distilled water, what happens to the vapor pressure of the liquid?

- (a) It decreases.
- (b) It increases.
- (c) It doubles.
- (d) It is not affected.

**15** The opposite figure shows a stone submerged at a certain depth beneath the surface of a liquid, so that the lower surface of stone experiences a certain pressure, so what can reduce the pressure on the stone?

- (a) Dissolving salt in water.
- (b) Raising the stone up slightly.
- (c) Dropping the stone to the bottom of the container.
- (d) Moving the stone horizontally at the same depth.



**16** A quantity of pure water has a volume of  $20 \text{ cm}^3$  at a temperature of  $4^\circ\text{C}$ , so what is its mass?

- (a) 10 g
- (b) 20 g
- (c) 100 g
- (d) 200 g

**17** Which of the following is from the direct results for increasing the concentration of fertilizers in agricultural drainage water?

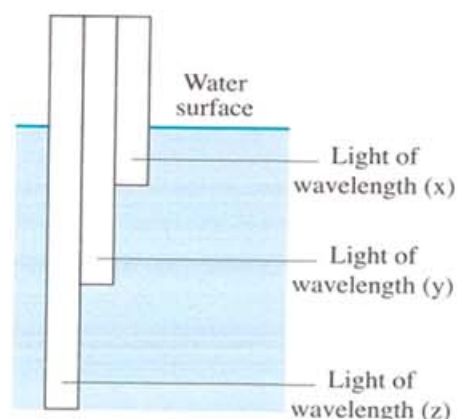
- (a) Abnormal algal blooming.
- (b) Flourishing of fisheries.
- (c) Excessively decrease in nutrients.
- (d) Inhibition of algae growth.

**18** The ratio between the number of hydroxide ions in ammonium chloride solution to their number in ammonium bicarbonate solution is .....

- (a) less than 1
- (b) greater than 1
- (c) equal to 1
- (d) cannot be determined

**19** The opposite figure represents three beams of visible light with wavelengths (x), (y), and (z) passing through ocean water, so the correct arrangement of these wavelengths is .....

- (a)  $x > y > z$
- (b)  $z > y > x$
- (c)  $x = y = z$
- (d)  $z > x > y$



**20** Which of the following is **not** considered a biological importance for forecasting potential climate changes?

- (a) Protecting humans from respiratory diseases.
- (b) Protecting sensitive organisms.
- (c) Choosing appropriate planting dates.
- (d) Changing rainfall patterns.

**Answer the following questions (21 & 22):**

**21** A quantity of water with a mass of 100 g gained 25.2 kJ of heat, so that its temperature changed from 40°C to 100°C, then the water gained 226 kJ of heat to turn into water vapor at 100°C, **calculate:**

- (a) The specific heat capacity of water.
- (b) The latent heat of vaporization for water.

.....  
.....

**22 Explain:** The wood frog produces large amounts of glucose in its vital organs at the beginning of winter.

.....  
.....



# Answers of General Exams



## Answers of Exam 1

| Question no. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--------------|---|---|---|---|---|---|---|---|---|----|
| Answer       | a | b | d | c | b | d | b | d | b | d  |

| Question no. | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|--------------|----|----|----|----|----|----|----|----|----|----|
| Answer       | a  | a  | b  | d  | d  | b  | a  | a  | a  | d  |

21 & 22 Answer by yourself.

## Answers of Exam 2

| Question no. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--------------|---|---|---|---|---|---|---|---|---|----|
| Answer       | c | d | c | c | a | c | b | b | d | d  |

| Question no. | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|--------------|----|----|----|----|----|----|----|----|----|----|
| Answer       | b  | b  | c  | a  | c  | c  | b  | b  | c  | c  |

21 : 23 Answer by yourself.

## Answers of Exam 3

| Question no. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--------------|---|---|---|---|---|---|---|---|---|----|
| Answer       | a | a | a | a | b | c | d | c | d | b  |

| Question no. | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|--------------|----|----|----|----|----|----|----|----|----|----|
| Answer       | c  | a  | b  | c  | b  | b  | a  | a  | b  | b  |

21 & 22 Answer by yourself.

## Answers of Exam 4

| Question no. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--------------|---|---|---|---|---|---|---|---|---|----|
| Answer       | a | a | d | c | b | c | d | c | c | a  |

| Question no. | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|--------------|----|----|----|----|----|----|----|----|----|----|
| Answer       | b  | b  | a  | a  | c  | a  | b  | a  | d  | c  |

21 : 23 Answer by yourself.

## Answers of Exam 5

| Question no. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--------------|---|---|---|---|---|---|---|---|---|----|
| Answer       | b | a | b | d | b | c | d | d | b | d  |

| Question no. | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|--------------|----|----|----|----|----|----|----|----|----|----|
| Answer       | b  | a  | b  | c  | b  | a  | b  | c  | b  | c  |

21 & 22 Answer by yourself.

## Answers of Exam 6

| Question no. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--------------|---|---|---|---|---|---|---|---|---|----|
| Answer       | a | a | c | a | c | a | c | b | d | c  |

| Question no. | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|--------------|----|----|----|----|----|----|----|----|----|----|
| Answer       | c  | c  | c  | d  | b  | c  | a  | b  | c  | b  |

21 & 22 Answer by yourself.

## Answers of Exam 7

| Question no. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--------------|---|---|---|---|---|---|---|---|---|----|
| Answer       | d | c | b | c | a | b | c | a | c | a  |

| Question no. | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|--------------|----|----|----|----|----|----|----|----|----|----|
| Answer       | d  | a  | d  | a  | c  | a  | b  | a  | c  | c  |

21 & 22 Answer by yourself.

## Answers of Exam 8

| Question no. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--------------|---|---|---|---|---|---|---|---|---|----|
| Answer       | c | d | a | c | a | b | a | b | c | a  |

| Question no. | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|--------------|----|----|----|----|----|----|----|----|----|----|
| Answer       | b  | b  | c  | d  | d  | a  | d  | d  | c  | b  |

21 & 22 Answer by yourself.

## Answers of Exam 9

| Question no. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--------------|---|---|---|---|---|---|---|---|---|----|
| Answer       | d | b | d | c | c | c | a | d | a | c  |

| Question no. | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|--------------|----|----|----|----|----|----|----|----|----|----|
| Answer       | a  | b  | c  | c  | c  | d  | d  | c  | a  | b  |

21 & 22 Answer by yourself.

## Answers of Exam 10

| Question no. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--------------|---|---|---|---|---|---|---|---|---|----|
| Answer       | a | b | b | d | b | c | d | a | a | c  |

| Question no. | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|--------------|----|----|----|----|----|----|----|----|----|----|
| Answer       | d  | d  | a  | a  | b  | b  | a  | a  | a  | d  |

21 & 22 Answer by yourself.



حمل الآن

مجاناً وحصرياً

# المراجعة رقم (3)

## الترم الاول



## Lesson 1: The Hydrosphere

### Key Concepts

#### ◆ Environment

All the conditions and elements surrounding humans and other living organisms that affect life.

#### ◆ Origin of the Word “Environment”

From the French “*Environ*” meaning “surround” or “everything that surrounds us.”

#### ◆ Features of the Environment

Includes *physical & chemical elements* (air, soil, sunlight) and *biological elements* (humans, animals, plants, microorganisms).

These components are inseparable because of their continuous interaction.

#### ◆ Ecosystem

A community of living organisms that interact with each other and with the non-living parts of their surroundings to adapt to changing conditions.

#### ◆ Hydrosphere

All water found on Earth, including oceans, seas, rivers, lakes, underground water, ice, and vapor.

#### ◆ Water Cycle (Hydrological Cycle)

The continuous movement of water around the Earth in solid, liquid, and gas forms within a closed system.

#### ◆ Transpiration

The process by which plants get rid of excess water as vapor from parts exposed to air.

#### ◆ Excretion

The process by which organisms get rid of waste products resulting from metabolic activities.

---



### Comparison / Relationship Tables

#### Components of the Environment

| Type                                     | Elements              | Examples                                |
|------------------------------------------|-----------------------|-----------------------------------------|
| <b>Physical &amp; Chemical (Abiotic)</b> | Non-living components | Air, soil, sunlight                     |
| <b>Biological (Biotic)</b>               | Living components     | Humans, animals, plants, microorganisms |

#### Natural Environment Spheres

| Sphere             | Description                   | Example                 |
|--------------------|-------------------------------|-------------------------|
| <b>Hydrosphere</b> | All water on Earth            | Oceans, rivers, lakes   |
| <b>Atmosphere</b>  | Air surrounding Earth         | Weather and gases       |
| <b>Lithosphere</b> | Solid layer of rocks and soil | Mountains and ground    |
| <b>Biosphere</b>   | All living things             | Humans, animals, plants |

#### Water Distribution on Earth

| Type of Water          | Percentage           | Description                                      |
|------------------------|----------------------|--------------------------------------------------|
| <b>Salt Water</b>      | 97%                  | Found in oceans, seas, salt lakes; not drinkable |
| <b>Fresh Water</b>     | 1%                   | Found in rivers, lakes, groundwater; usable      |
| <b>Frozen Water</b>    | 2% of total          | Found in polar ice caps and glaciers             |
| <b>Surface vs Land</b> | 70% water – 30% land | Coverage of Earth's surface                      |

#### Types of Water Cycle Effects

| Type of Effect    | Description                           | Example                      |
|-------------------|---------------------------------------|------------------------------|
| <b>Physical</b>   | Shapes land by erosion and deposition | Valleys and deltas           |
| <b>Biological</b> | Supports life and ecosystems          | Water for plants and animals |
| <b>Chemical</b>   | Dissolves and transports minerals     | Rock weathering              |

**Processes of the Water Cycle**

| Process                       | Description                                        | Result                   |
|-------------------------------|----------------------------------------------------|--------------------------|
| <b>Evaporation</b>            | Water turns into vapor from oceans, lakes, etc.    | Water enters atmosphere  |
| <b>Condensation</b>           | Vapor cools and changes to droplets forming clouds | Cloud formation          |
| <b>Precipitation</b>          | Droplets fall to Earth as rain, snow, etc.         | Water returns to surface |
| <b>Infiltration (Seepage)</b> | Water seeps through soil and rocks                 | Forms groundwater        |
| <b>Biological Processes</b>   | Living things release or lose water                | Keeps cycle continuous   |

**Transpiration and Excretion in Plants**

| Process                     | Definition                                                       | Function                                        |
|-----------------------------|------------------------------------------------------------------|-------------------------------------------------|
| <b>Transpiration</b>        | Loss of water vapor from leaves through stomata                  | Lowers plant temperature and pulls water upward |
| <b>Excretion</b>            | Removal of metabolic wastes                                      | Maintains balance in organisms                  |
| <b>Water Movement Steps</b> | 1. Roots absorb → 2. Stem pulls upward → 3. Leaves release vapor | Maintains continuous flow of water              |

**Q & A Section**

? What makes Earth called the “blue planet”?

... Because most of its surface is covered with water.

? Why is the hydrosphere important?

... It makes life possible; without it, no living organisms could survive.

? What is another name for the water cycle?

... The hydrological cycle.

? What are the openings on leaves where transpiration occurs? ... Stomata.

? Which process allows humans and animals to release water vapor?

... Respiration and excretion.



? What kind of system is the water cycle described as?

... A nearly closed system where water continuously moves and changes state within Earth's natural temperature range.

? What are the **three main ways** the water cycle changes Earth's surface?

... Physically (erosion/deposition), biologically (supports ecosystems), and chemically (dissolves and transports minerals).

? What are the **two additional biological processes** besides transpiration that release water?

... Respiration and Excretion — both in plants, animals, and humans.

? Through what part of the plant does transpiration mainly occur?

... Tiny microscopic openings on the surfaces of leaves and green stems called **stomata**.

? What are the **nitrogenous waste products** mentioned in excretion?

... Ammonia, urea, and uric acid.

? What gases and substances are excreted by organisms?

... Carbon dioxide, water vapor, and nitrogenous wastes.

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### Common Mistakes & Exam Traps

-  forgetting the effect of water cycle: physical, chemical, and biological
-  excretion is not by animals only, plants also excrete.
-  Respiration is not done by animals only, plants respire too.
-  Mixing respiration and transpiration — one releases CO<sub>2</sub>, the other water vapor.

Lesson 2: Chemical Properties of Water Key Concepts

- ◆ **Covalent bond:** A chemical bond where two atoms share one or more electrons.
- ◆ **Electronegativity:** An atom's ability to attract bonding electrons for a longer time.
- ◆ **Polarity of water:** Unequal sharing of bonding electrons → O becomes  $\delta^-$ , H becomes  $\delta^+$ .
- ◆ **Hydrogen bond:** Electrostatic attraction between  $\delta^+$  H of one water molecule and  $\delta^-$  O of a neighbor; each molecule can form up to four H-bonds (network).
- ◆ **Universal solvent:** Water dissolves many substances (ionic & polar covalent).
- ◆ **Ionic equilibrium of pure water:** Slight ionization to equal  $H^+$  and  $OH^-$  → neutral.
- ◆ **Hydrolysis of salts:** When a solid salt dissolves in water producing an acid and a base where one or both are weak.
- ◆ **pH:** A quantitative measure (0–14) of acidity/basicity describing the relation between  $[H^+]$  and  $[OH^-]$ .
- ◆ **Molecular mass rule (boiling point):** Higher molecular mass → usually higher b.p. (exception: water due to H-bonding).
- ◆ **Neutralization law:** Base + Acid → Water (l) + Salt (s).

 Comparison / Relationship Tables**A) Water Structure → Polarity → Hydrogen Bonding → Boiling Point**

|                                     | Facts                                                                                                         | result                                                            |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| <b>Molecular structure</b>          | 1 O + 2 H<br>O $\approx$ 88.89%, H $\approx$ 11.11%<br>two single covalent bonds, bond angle $\approx$ 104.5° | Bent shape supports uneven charge distribution                    |
| <b>Electronegativity difference</b> | O attracts electrons more strongly than H                                                                     | Partial charges: O ( $\delta^-$ ), H ( $\delta^+$ )<br>→ polarity |
| <b>Hydrogen bonding</b>             | $\delta^+$ H– $\delta^-$ O attraction<br>each molecule forms up to <b>four</b> H-bonds                        | Explains <u>high boiling point</u> and <u>solvent ability</u>     |
| <b>Boiling point comparison</b>     | Water boiling point 100 °C<br>vs H <sub>2</sub> S –61 °C (heavier)                                            | Exception to mass rule caused by H-bond network                   |



## B) Dissolution vs Hydrolysis

| Process                                           | What Happens in Water                                       | Example / Orientation                                                                                                | Outcome                                                 |
|---------------------------------------------------|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| <b>Dissolution<br/>(dissociation + hydration)</b> | Ionic lattice splits into free ions - water surrounds ions  | $\text{Na}^+ \rightarrow$ surrounded by O ( $\delta^-$ )<br>$\text{Cl}^- \rightarrow$ surrounded by H ( $\delta^+$ ) | No acid/base<br>$\rightarrow$ not hydrolysis            |
| <b>Hydrolysis of salts</b>                        | Salt reacts with water forming acid/base (one or both weak) | Acid/ Base/ Neutral                                                                                                  | changes $[\text{H}^+]$ or $[\text{OH}^-]$ concentration |

## C) Classes of Salts in Water + pH Relation

|                     | Ion Change                                           | Resulting Solution                   | Example                                                                                                  |
|---------------------|------------------------------------------------------|--------------------------------------|----------------------------------------------------------------------------------------------------------|
| <b>Acidic salt</b>  | $\uparrow [\text{H}^+]$ , $\downarrow [\text{OH}^-]$ | Acidic ( $\text{pH} < 7$ )           | $\text{NH}_4\text{Cl} + \text{H}_2\text{O} \rightarrow \text{NH}_4\text{OH} + \text{H}^+ + \text{Cl}^-$  |
| <b>Basic salt</b>   | $\uparrow [\text{OH}^-]$ , $\downarrow [\text{H}^+]$ | Basic / Alkaline ( $\text{pH} > 7$ ) | $\text{NaHCO}_3 + \text{H}_2\text{O} \rightarrow$<br>$\text{Na}^+ + \text{OH}^- + \text{H}_2\text{CO}_3$ |
| <b>Neutral salt</b> | No net change in $[\text{H}^+]$ or $[\text{OH}^-]$   | Neutral ( $\text{pH} = 7$ )          | $\text{NH}_4\text{HCO}_3 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3 + \text{NH}_4\text{OH}$  |
| <b>Pure water</b>   | $[\text{H}^+] = [\text{OH}^-]$                       | Neutral ( $\text{pH} = 7$ )          | —                                                                                                        |

 Q & A Section How does water support cell life? It moves through the plasma membrane carrying needed materials in and wastes out. Why is natural surface water rarely completely pure? It contains many ions and chemicals that are dissolved in or interact with it. Why does water's boiling point exceed that of  $\text{H}_2\text{S}$  despite lower mass? Because extensive hydrogen bonding requires extra energy to break. Show NaCl dissolution (not hydrolysis).  $\text{NaCl (s)} \rightarrow \text{Na}^+ \text{ (aq)} + \text{Cl}^- \text{ (aq)}$  in  $\text{H}_2\text{O}$ ; ions are hydrated, no new acid/base forms.

**? What part of water surrounds  $\text{Na}^+$  and  $\text{Cl}^-$  ions?**

... Oxygen ( $\delta^-$ ) surrounds  $\text{Na}^+$ ; hydrogen ( $\delta^+$ ) surrounds  $\text{Cl}^-$ .

**? Steps to measure pH using a meter.**

... Calibrate with distilled water → dry electrode → immerse → record stable reading.

**? Steps to measure pH using test strips.**

... Dip strip → wait a few seconds → compare color with chart.

**? Why is water essential for life according to the lesson?**

... It dissolves various chemicals, enabling transport of nutrients and waste in cells.

**? Besides other water molecules, what else can water form H-bonds with?**

... Other polar covalent molecules, not only water.

**? Do  $\text{Na}^+$  and  $\text{Cl}^-$  form bonds with water molecules?**

... No, they remain hydrated ions without forming new bonds.

**? In which fields is the term pH commonly used?**

... Chemistry, biology, and agriculture.

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**⊘ Common Mistakes & Exam Traps**

⚠ Calling NaCl dissolution “**hydrolysis**” — it’s dissociation + hydration (no new acid/base).

⚠ Forgetting that **H-bonding**, not mass, explains water’s high boiling point.

⚠ Confusing **pH meanings**: neutral = 7, acidic < 7, basic > 7.



Lesson 3: Physical Properties of Water **Key Concepts**

- ◆ **Density:** Mass per unit volume of a substance at a given temperature.
- ◆ **Relative Density:** Ratio of a substance's density to the density of **pure water at 4 °C**.
- ◆ **Quantity of Heat ( $Q_{th}$ ):** Thermal energy transferred because of a temperature difference.
- ◆ **Internal energy** of a body is the **sum of kinetic and potential energies** of its particles.
- ◆ **Temperature:** Measure related to the **average kinetic energy** of particles.
- ◆ **Specific Heat (c):** Heat required to raise the temperature of **1 kg** of a substance by **1 K** unit **J/kg·K**.
- ◆ **Latent Heat of Vaporization:** Heat absorbed by **1 kg** during **liquid  $\rightleftharpoons$  gas** change at constant temperature (or released on condensation).
- ◆ **Law of Buoyancy (for hydrometer):** A floating body sinks **more** in a **less-dense** liquid and **float more** in a **denser** liquid.
- ◆ **Hydrometer:** Instrument for measuring density/relative density of liquids; sealed glass tube with weighted bulb and **graduated stem**.

 **Comparison / Relationship Tables****Pure Water & Basic Density Relations**

| Item                               | Fact                                                                       | Relation / Result                                                                            |
|------------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| Pure water                         | Density of pure water at 4 °C is the highest                               | Relative density compares to this value<br><b>1 g/cm<sup>3</sup> = 1000 kg/m<sup>3</sup></b> |
| Density change<br>(mass vs volume) | If <b>volume constant</b> and <b>mass increases</b><br>→ density increases | $\rho \propto m$<br>when V is fixed                                                          |
| Density change<br>(mass vs volume) | If <b>mass constant</b> and <b>volume increases</b><br>→ density decrease  | $\rho \propto 1/V$<br>when m is fixed                                                        |
| Factors affecting density          | <b>Mass of molecules,</b><br><b>spacing between molecules</b>              | Change V or m → change $\rho$                                                                |

**Water Density vs Temperature (Anomalous Behavior)**

| Temperature Range | What Happens             | Reason / Mechanism                                                 | Outcome                                                              |
|-------------------|--------------------------|--------------------------------------------------------------------|----------------------------------------------------------------------|
| 0 °C → 4 °C       | Density <b>increases</b> | Molecules move closer; volume decreases                            | Maximum density at <b>4 °C</b>                                       |
| 4 °C → 0 °C       | Density <b>decreases</b> | Structure expands molecules farther apart (ice < dense than water) | <b>Ice floats</b> ; surface freezes first, deeper water stays liquid |

**Ocean Water Density (Depth, Salinity, Temperature) & current**

| Factor                         | Fact                                                                                            | Mechanism                                     | Effect                                                       |
|--------------------------------|-------------------------------------------------------------------------------------------------|-----------------------------------------------|--------------------------------------------------------------|
| <b>Depth / Pressure</b>        | In shallow water density changes little at <b>great depths</b> density may rise <b>slightly</b> | High pressure packs molecules slightly closer | Slight density increase at depth                             |
| <b>Salinity</b>                | Higher <b>dissolved salts</b> → <b>higher density</b>                                           | More mass per volume                          | Dense water masses                                           |
| <b>Temperature</b>             | Increase in temperature above <b>4 °C</b> cause a decrease in density                           | Molecules spacing increase                    | Density decrease                                             |
| <b>Density-driven currents</b> | <b>Differences in density</b> (temp + salinity + pressure) drive <b>vertical currents</b>       | Denser water sinks lighter rises              | Transports <b>heat, salt, nutrients, freshwater</b> globally |

**Sea Breeze (Daytime) as an Effect of Water's High (c)**

| Stage                  | Fact                                        | Mechanism                               | Result                                                      |
|------------------------|---------------------------------------------|-----------------------------------------|-------------------------------------------------------------|
| <b>Daytime heating</b> | Land heats faster than water                | Air over land warms, becomes less dense | Hot air rises                                               |
| <b>Air flow</b>        | Cooler air above water <b>moves to land</b> | Replaces rising warm air                | <b>Sea breeze</b> cools coast water stays nearly constant T |



## Temperature, Heat &amp; Conversion

| Item                   | Fact                                                                            | Relation / Formula                                     | Practical Note                                         |
|------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------|
| Temperature vs Heat    | Temp $\leftrightarrow$ kinetic energy<br>Heat $\leftrightarrow$ energy transfer | Different physical meanings                            | Heat $\rightarrow$ Joules<br>Temp $\rightarrow$ Kelvin |
| Celsius–Kelvin         | $T_k = t^{\circ}\text{C} + 273$                                                 | $+1^{\circ}\text{C} = +1\text{ K}$<br>(same step size) | Use either K or $^{\circ}\text{C}$ for $\Delta t$      |
| When a body gains heat | Molecular vibration & KE increase                                               | $\Rightarrow$ Temperature rises                        | Internal energy increase                               |

## Specific Heat Capacity (c)

| Point                           | Fact                                                                  | Mechanism / Consequence                                     | Examples                                                                                                  |
|---------------------------------|-----------------------------------------------------------------------|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Specific Heat (c)               | Heat to raise 1 kg by 1 K<br>unit J/kg·K                              | Higher c $\rightarrow$ more heat needed for same $\Delta t$ | Sand $\rightarrow$ low (c) $\rightarrow$ Heat fast<br>Water $\rightarrow$ high(c) $\rightarrow$ Heat slow |
| Factors affecting Specific Heat | Type of material<br>Physical state<br>impurities/dissolved substances | Structure & bonding<br>change energy storage                | —                                                                                                         |
| Water's high Specific Heat      | Due to hydrogen bonds                                                 | Moderates climate<br>near large water bodies                | Large surfaces hold heat,<br>release slowly                                                               |

## Latent Heat of Vaporization &amp; Biological Cooling

| Item                        | Fact                                                                                | Mechanism                                                                |
|-----------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Latent Heat of Vaporization | Heat absorbed by 1 kg on evaporation<br>(or released on condensation) at constant T | Phase change without $\Delta T$                                          |
| Why high for water          | Hydrogen bonds must be broken                                                       | Requires a lot of energy                                                 |
| Biological cooling          | Sweating / transpiration use evaporation                                            | Evaporating molecules carry heat away<br>Helps regulate body temperature |

**Hydrometer: Structure & Principle**

|                      | <b>Fact</b>                                                                                                                                              | <b>Function</b>                                                   |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| <b>Principle</b>     | Works by <b>law of buoyancy</b>                                                                                                                          | Sinks more in less-dense liquids,<br>float more in denser liquids |
| <b>Structure</b>     | <b>Sealed glass tube</b> , <b>wider lower part</b> for buoyancy<br><b>lead/mercury balls</b> for balance<br><b>long stem</b> with <b>graduated scale</b> | Ensures stable vertical float<br>& readable scale                 |
| <b>Scale reading</b> | <b>Bottom</b> of scale = <b>highest density</b><br><b>Top</b> of scale = <b>lowest density</b>                                                           | Read at liquid surface level                                      |

**Thermal Relations (Formulas & Units)**

| <b>Relation</b>                   | <b>Formula / Unit</b>                                                                                      | <b>Meaning</b>                                                                                                                                                                     |
|-----------------------------------|------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Amount of heat gained/lost</b> | $Q_{th} = m c \Delta t$                                                                                    | $m \rightarrow \text{kg}$<br>$c \rightarrow \text{J/kg}\cdot\text{K} \text{ or } \text{J/kg}\cdot^{\circ}\text{C}$<br>$\Delta t \rightarrow \text{K} \text{ or } ^{\circ}\text{C}$ |
| <b>Unit links</b>                 | $1 \text{ g/cm}^3 = 1000 \text{ kg/m}^3 = 1 \text{ kg/L}$<br>relative density = density in $\text{g/cm}^3$ | Used in problems                                                                                                                                                                   |
| <b>Kelvin–Celsius</b>             | $T_K = t^{\circ}\text{C} + 273$<br>Step size: $1^{\circ}\text{C} = 1 \text{ K}$                            | Either scale usable for $\Delta t$                                                                                                                                                 |

**Cold-Blooded vs Warm-Blooded Organisms**

| <b>Feature</b>                       | <b>Cold-Blooded Organisms</b>                                                | <b>Warm-Blooded Organisms</b>               |
|--------------------------------------|------------------------------------------------------------------------------|---------------------------------------------|
| <b>Definition</b>                    | Body temperature changes according to the surrounding environment.           | Maintain nearly constant body temperature.  |
| <b>Relation to Water Temperature</b> | Directly affected by water temperature<br>their body temperature follows it. | Less affected by water temperature changes. |
| <b>Adaptation</b>                    | Live mainly in deep water where temperature is stable.                       | Can live in wider temperature ranges.       |



 **Q & A Section**

? Which organisms depend directly on environmental temperature?

... **Cold-blooded** animals (e.g., reptiles, fish, amphibians).

? During daytime, what happens to large bodies of water thermally?

... They **absorb solar energy** but maintain **nearly constant temperature**.

? What are the main drivers of **vertical ocean currents**?

... **Density differences** due to **temperature** and **salinity** and **pressure** variations.

? What does “density of pure water = 1 g/cm<sup>3</sup> at 4 °C” mean exactly?

... The mass of **1 cm<sup>3</sup>** of water at **4 °C** equals **1 g**.

? Why doesn't water density change a lot with depth in **shallow** oceans?

... Because water is **almost incompressible**.

? What is the **SI unit** of temperature used in the lesson?

... **Kelvin (K)**.

? What happens to large water bodies at **night**?

... They **slowly lose** the energy absorbed during the day.

? What temperature needs do **most organisms** have?

... They require a **specific range** of temperature; **severe changes** can be **fatal**, especially for **very small organisms**.

? How does water temperature affect **marine organism distribution**?

... Distribution depends on water temperature, **warm-surface** species may not live in **cold depths**.

? Give a **specific example** of temperature sensitivity in marine ecosystems.

... **Coral reefs** need specific temperatures; climate-change **warming** can lead to **coral death**.

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 **Common Mistakes & Exam Traps**

! Water's **maximum density** (1000 kg/m<sup>3</sup>) is at **4 °C**, not at 0 °C.

! **Bottom mark** on a hydrometer scale = **highest density**; top mark = lowest.

! **1 °C change = 1 K change** (same step size), though zero points differ.

Lesson 4: Properties of Aqueous Solutions **Key Concepts**

- ◆ **Solution** — A homogeneous mixture of a solvent and a solute. In most cases, water is the solvent.
- ◆ **Concentration** — The amount of solute in a given volume of solvent.
- ◆ **Colligative Properties** — Properties that depend on the number of solute particles, not their type.
- ◆ **Vapor Pressure** — The pressure exerted by vapor above a liquid in dynamic equilibrium with it.
- ◆ **Boiling Point** — The temperature at which the vapor pressure equals the atmospheric pressure.
- ◆ **Freezing Point** — The temperature at which a liquid turns into a solid.
- ◆ **Osmosis** — Movement of water from a dilute to a concentrated solution through a semi-permeable membrane.
- ◆ **Osmotic Pressure** — The pressure caused by differences in solute concentration across a membrane.

 **Comparison / Relationship Tables****Effect of Solute on Vapor Pressure**

| Property              | Pure Water                             | Solution                                       | Explanation                                                              |
|-----------------------|----------------------------------------|------------------------------------------------|--------------------------------------------------------------------------|
| Pressure Value        | Greater                                | Lower                                          | Solute molecules reduce the number of water molecules able to evaporate. |
| Liquid Surface        | Only water molecules                   | Water + solute molecules                       | Solute occupies part of the surface area.                                |
| Intermolecular Forces | Hydrogen bonds between water molecules | Stronger attraction between solute and solvent | More energy needed to free water molecules.                              |



**Boiling Point of Pure Water vs Solution**

| Property                     | Pure Water                              | Solution                             | Observation                                              |
|------------------------------|-----------------------------------------|--------------------------------------|----------------------------------------------------------|
| <b>Boiling Point</b>         | 100°C                                   | Above 100°C                          | Solute raises boiling point (direct relation).           |
| <b>Intermolecular Forces</b> | Between water molecules only            | Between solute and solvent molecules | Stronger attraction increases energy needed for boiling. |
| <b>Air Pressure Relation</b> | Constant at normal atmospheric pressure | Increases boiling point when higher  | Boiling point varies with external pressure.             |

**Freezing Point of Pure Water vs Solution**

| Property              | Pure Water                      | Solution                    | Observation                           |
|-----------------------|---------------------------------|-----------------------------|---------------------------------------|
| <b>Freezing Point</b> | 0°C                             | Below 0°C                   | Solute hinders ice crystal formation. |
| <b>Reason</b>         | Water molecules form ice freely | Solute disrupts arrangement | Freezing point depression occurs.     |
| <b>Example</b>        | Pure water forms ice easily     | Salty water freezes slower  | Used to prevent road ice formation.   |

**Osmosis and Osmotic Pressure**

| Concept                 | Definition                                       | Direction                       | Example                             |
|-------------------------|--------------------------------------------------|---------------------------------|-------------------------------------|
| <b>Osmosis</b>          | Water moves from dilute to concentrated solution | Through semi-permeable membrane | Potato in salt water becomes crisp. |
| <b>Osmotic Pressure</b> | Pressure due to solute concentration difference  | Higher in concentrated solution | Draws water from dilute side.       |

 **Q & A Section**

? What are the four main colligative properties of solutions?

... Decrease in vapor pressure, elevation of boiling point, depression of freezing point, and osmotic pressure.

? What determines colligative properties?

... The number of solute particles, not their type.

? Why does salt lower water's freezing point?

... Salt hinders water molecules from forming ice crystals.

? Why do we soak potatoes in salt water before frying?

... To draw out water by osmosis, making them crispier.

? What real-life application shows how increasing pressure raises the boiling point?

... A pressure cooker increases internal pressure, raising water's boiling point above 100 °C and cooking food faster.

? What happens to the boiling point of water at high altitudes?

... It drops below 100 °C because atmospheric pressure decreases with altitude.

? Why is the boiling point of a liquid used to test its purity?

... A pure liquid boils at a fixed temperature under normal pressure, while impurities change that temperature.

? Which solution freezes at a lower temperature:  $\text{Na}_3\text{PO}_4$  or KCl (same concentration)?

...  $\text{Na}_3\text{PO}_4$  solution freezes at a lower temperature because it produces more ions in water.

? Why is salt spread on icy roads in cold regions?

... To form a saline solution whose freezing point is lower than water, reducing ice formation and car slippage.

---

 **Common Mistakes & Exam Traps**

! Assuming the boiling point of all liquids is 100°C — only pure water under 1 atm.

! Forgetting that solutes lower the freezing point, not raise it.

! Mixing osmosis direction — water moves from the low concentrated solution → the high concentrated solution.



### Lesson 5 Biological Importance of Water

#### Key Concepts

- ◆ **Organic Molecules** — Carbohydrates, proteins, and lipids that form living cells.
- ◆ **Inorganic Molecules** — Water and mineral salts present in all living cells.
- ◆ **Cell** — The smallest structural and functional unit of living organisms.
- ◆ **Prokaryotic Cells** — Cells with no nucleus; genetic material is has no nucleus membrane and has few organelles.
- ◆ **Eukaryotic Cells** — Cells with a nucleus surrounded by a nuclear membrane and containing organelles.
- ◆ **Metabolism** — Continuous biochemical reactions in cells necessary for life, and need water to be done.
- ◆ **Enzymes** — Protein biocatalysts that speed up reactions without being consumed.
- ◆ **Activation Energy** — Minimum energy required to start a reaction; enzymes lower it.
- ◆ **Anabolism** — Building complex molecules from simple ones (energy-consuming).
- ◆ **Catabolism** — Breaking complex molecules into simpler ones (energy-releasing).
- ◆ **Water** — Makes up about 70% of body mass, 47% inside the cell, 23% outside the cell; acts as solvent, reaction support, temperature regulator, and structure supporter.
- ◆ **Cytoplasm** — Mostly water containing dissolved salts and essential chemicals.

---

#### Comparison / Relationship Tables

##### Distribution of Water in Mammalian Bodies

| Location      | Water % | Description                                 | Example             |
|---------------|---------|---------------------------------------------|---------------------|
| Inside cells  | 47%     | Found in cytoplasm and organelles           | Intracellular fluid |
| Outside cells | 23%     | Found in blood plasma and other body fluids | Extracellular fluid |
| Total         | 70%     | the most abundant chemical                  | Human body          |

## Prokaryotic vs Eukaryotic Cells

| Feature    | Prokaryotic      | Eukaryotic                                                |
|------------|------------------|-----------------------------------------------------------|
| Nucleus    | Absent           | Present with nuclear membrane                             |
| Organelles | None or few      | Specialized organelles present ex: Mitochondria, plastids |
| Cell Wall  | Peptidoglycan    | Cellulose (plants) or chitin (fungi)                      |
| Complexity | Simple structure | Complex structure                                         |
| Example    | Bacteria         | Human, yeast, plant cells                                 |

## Four Kingdoms of Eukaryotes

| Kingdom  | Structure                           | Nutrition                    | Key Feature                         | Examples                               |
|----------|-------------------------------------|------------------------------|-------------------------------------|----------------------------------------|
| Protista | Unicellular or simple multicellular | Autotrophic or heterotrophic | Mostly aquatic                      | Golden algae<br>Protozoa               |
| Fungi    | Mostly multicellular                | Heterotrophic                | Cell wall of chitin                 | Yeast (unicellular),<br>Mold, Mushroom |
| Plants   | Multicellular                       | Autotrophic (photosynthesis) | Cell wall of cellulose              | Grass, Trees                           |
| Animals  | Multicellular                       | Heterotrophic                | No cell wall<br>capable of movement | Humans, Birds, Fish                    |

## Autotrophic vs Heterotrophic Nutrition

| Feature           | Autotrophic                      | Heterotrophic                     |
|-------------------|----------------------------------|-----------------------------------|
| Energy Source     | Sunlight or inorganic compounds  | Organic food from other organisms |
| Main Process      | Photosynthesis or chemosynthesis | Ingestion or absorption           |
| Role in Nature    | Producers                        | Consumers or decomposers          |
| Example Organisms | Green plants, algae              | Animals, fungi, most bacteria     |

## Invertebrates vs Vertebrates

| Feature  | Invertebrates                                                                                                   | Vertebrates                                |
|----------|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Backbone | Absent                                                                                                          | Present                                    |
| Examples | sponges, coelenterates (jellyfish), worms, arthropods (insects), mollusks (like clams), echinoderms (starfish). | Fish, amphibians, reptiles, birds, mammals |



## Main Components of a Typical Eukaryotic Cell

| Part                         | Description                                                                          | Function                                            | Found In                                             |
|------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------|------------------------------------------------------|
| <b>Cell wall</b>             | Made of cellulose (plants)<br>Made of chitin (fungi)<br>Permeable to water and salts | Supports and gives shape                            | Plants, fungi                                        |
| <b>Cell membrane</b>         | Thin<br>Semi-permeable layer                                                         | Controls exchange of materials                      | All cells                                            |
| <b>Cytoplasm</b>             | Gel-like<br>Mostly water                                                             | The place for biochemical reactions                 | All cells                                            |
| <b>Nucleus</b>               | Contains DNA                                                                         | Controls cell activities                            | All eukaryotic cells<br>In the center of animal cell |
| <b>Chloroplasts</b>          | Contain chlorophyll                                                                  | Site of photosynthesis                              | Plant cells                                          |
| <b>Vacuoles</b>              | Storage<br>(Food, water, excess salts)                                               | Few large vacuoles (plants)<br>Many small (animals) | Plants and animals                                   |
| <b>Mitochondria</b>          | Powerhouse of the cell                                                               | Produces energy (ATP)                               | All eukaryotes                                       |
| <b>Endoplasmic reticulum</b> | Group of membranes                                                                   | Transports materials within the cell                | All eukaryotes                                       |

## Functions of Water in Living Organisms

| Function                      | Description                                                                        |
|-------------------------------|------------------------------------------------------------------------------------|
| <b>Solvent</b>                | Dissolves salts, and nutrients<br>Carry oxygen and carbon dioxide<br>Remove wastes |
| <b>Internal pressure</b>      | Resists the pressure resulting from external forces surrounding the cell           |
| <b>Structural</b>             | Maintains cell shape and turgidity                                                 |
| <b>Temperature Regulation</b> | High specific heat prevents quick temperature changes                              |
| <b>Metabolic Role</b>         | Participates in and supports biochemical reactions                                 |

## Metabolic Processes in Cells

| Type              | Definition                    | Example                           | Energy Effect   |
|-------------------|-------------------------------|-----------------------------------|-----------------|
| <b>Anabolism</b>  | Builds complex molecules      | Protein synthesis, photosynthesis | Consumes energy |
| <b>Catabolism</b> | Breaks down complex molecules | Respiration, glucose breakdown    | Releases energy |

### Enzymes and Their Action

|                           | Description                                                                                                         |
|---------------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>Nature</b>             | Proteins acting as catalysts (activator / biocatalyst)                                                              |
| <b>Mechanism</b>          | Lock-and-Key model: substrate fits enzyme active site                                                               |
| <b>Activation Energy</b>  | Enzymes lower the energy required to start a reaction                                                               |
| <b>Life</b>               | Enzymes are not consumed during reactions                                                                           |
| <b>Working Conditions</b> | Each enzyme works best at a specific pH and temperature<br>Efficiency decreases if we deviate from these conditions |

### Q & A Section

? What are the two main types of molecules in cells?

... Organic (carbohydrates, proteins, lipids) and inorganic (water, mineral salts).

? What gives external support to plant and fungal cells?

... Cellulose in plant walls and chitin in fungal walls.

? What gives internal support to all cells?

... Water found in cytoplasm (internal pressure that resist external effects).

? How does water maintain cell structure?

... By creating internal pressure and supporting cell walls.

? What are examples of anabolic and catabolic reactions?

... Anabolic: photosynthesis, protein synthesis | Catabolic: cellular respiration, digestion.

? How do enzymes lower activation energy?

... They act as biocatalysts, making reactions faster with less energy used.

? What happens when enzyme pH or temperature changes significantly?

... Activity decreases and may stop completely due to structure change.

? Which organisms are autotrophic and which are heterotrophic?

... Plants and algae are autotrophic; animals, fungi, and most bacteria are heterotrophic.



? In mammals, where is the extracellular water specifically found?

☞ In blood plasma and other body fluids.

? Give the two nutrition modes shown in Protista with one example each.

☞ Autotrophic (golden algae) and heterotrophic (protozoa).

? What does the cell membrane do?

☞ Separates cell components from the environment and protects them, and control transportation of water and minerals.

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### Common Mistakes & Exam Traps

 Not all cells have a nucleus — prokaryotic cells do not.

 Not all cell walls are cellulose only plant cell — fungi (chitin) and prokaryotes (peptidoglycan).

 Confusing autotrophic and heterotrophic organisms.

**Multiple-Choice Questions**

- 1)** A continuous change between the three states of water on Earth's surface within a closed system is called the ..... cycle.  
a) Nitrogenous   b) Carbonaceous   c) Oxygenation   d) Hydrological
- 2)** Water covers about ..... of Earth's surface.  
a) 50%   b) 60%   c) 70%   d) 80%
- 3)** The percentage of salt water is about ..... of all water on Earth.  
a) 1%   b) 3%   c) 70%   d) 97%
- 4)** The percentage of fresh liquid water is about ..... of all water on Earth.  
a) 1%   b) 30%   c) 70%   d) 97%
- 5)** All the following are biotic factors in an environment EXCEPT ...  
a) Animals   b) Bacteria   c) Plants   d) Light
- 6)** All the following are abiotic factors EXCEPT ...  
a) Air   b) Water   c) Soil   d) Human
- 7)** It is where living organisms are found on, above, and below Earth's surface.  
a) Lithosphere   b) Biosphere   c) Atmosphere   d) Hydrosphere
- 8)** It is a blanket of gases surrounding Earth held by gravity.  
a) Lithosphere   b) Biosphere   c) Atmosphere   d) Hydrosphere
- 9)** Rigid, rocky outer layer of Earth (crust + upper rocks).  
a) Lithosphere   b) Biosphere   c) Atmosphere   d) Hydrosphere
- 10)** Refers to all forms of water—rivers, oceans, groundwater, vapor, ice.  
a) Lithosphere   b) Biosphere   c) Atmosphere   d) Hydrosphere
- 11)** Liquid water → vapor = ...  
a) Condensation   b) Transpiration   c) Evaporation   d) Precipitation
- 12)** Vapor → droplets = ...  
a) Condensation   b) Transpiration   c) Evaporation   d) Precipitation
- 13)** Plants release excess water through stomata = ...  
a) Condensation   b) Transpiration   c) Evaporation   d) Precipitation
- 14)** Stopping which process would most disrupt the water cycle?  
a) Surface runoff   b) Evaporation   c) Soil infiltration   d) Transpiration



- 15)** Increased transpiration affects the water cycle by ...  
a) Reducing rainfall                      b) Increasing atmospheric vapor  
c) Reducing evaporation                d) Fixing CO<sub>2</sub> in leaves
- 16)** The greatest source of water on Earth's surface is ...  
a) Oceans   b) Groundwater   c) Fresh lakes   d) Frozen rivers
- 17)** Which of the following is not related to the hydrological cycle?  
a) Water movement through many pathways   b) Living organisms play a role  
c) Keeping Earth stable                              d) Is nearly a closed system
- 18)** Consequence of transpiration through the water cycle = ...  
a) Evaporation   b) Leakage   c) Precipitation   d) Condensation
- 19)** Ratio (fresh liquid water : frozen fresh water) =  
a) 1/2   b) 2/1   c) 3/1   d) 1/1
- 20)** Ratio (lithosphere : hydrosphere coverage) =  
a) 3/7   b) 7/3   c) 3/11   d) 7/11
- 21)** Not a nitrogenous waste =  
a) Ammonia   b) Nitrogen gas   c) Urea   d) Uric acid
- 22)** The two essential elements that make up a water molecule are ...  
a) Carbon and hydrogen   b) Nitrogen and oxygen  
c) Oxygen and hydrogen   d) Chlorine and sodium
- 23)** What type of chemical bonds connect the hydrogen and oxygen atoms in a water molecule?  
a) Ionic   b) Hydrogen   c) Covalent   d) Metallic
- 24)** The approximate value of the angle between covalent bonds in a water molecule is ...  
a) 75.5°   b) 90°   c) 100°   d) 104.5°
- 25)** Which element represents the largest proportion of the mass of a water molecule?  
a) Hydrogen   b) Oxygen   c) Both equal   d) Cannot be determined
- 26)** Water is a polar compound because ...  
a) Electronegativity of oxygen > hydrogen   b) Hydrogen > oxygen  
c) Oxygen is  $\delta+$  / H is  $\delta-$                               d) Oxygen is  $\delta-$  / H is  $\delta+$
- 27)** All the following are consequences of the polarity of the water molecule EXCEPT ...  
a) Hydrogen bonds link water molecules   b) Ability to dissolve salts  
c) Boiling point rises to 100 °C                      d) Dissolves non-polar organic compound

**28)** The polarity of a water molecule is due to ...

- a) Oxygen becomes positive, hydrogen negative    b) Hydrogen > oxygen electronegativity  
c) Oxygen  $\delta+$  / hydrogen  $\delta-$     d) Oxygen  $\delta-$  / hydrogen  $\delta+$

**29)** The mass ratio of hydrogen : oxygen in a water molecule is ...

- a) 1 : 8    b) 1 : 9    c) 2 : 1    d) 8 : 9

**30)** The percentage of hydrogen mass in the water molecule equals ...

- a) 66.67%    b) 11.11%    c) 33.33%    d) 50%

**31)** Which type of bonds connect different water molecules together?

- a) Ionic    b) Hydrogen    c) Covalent    d) Metallic

**32)** The following equation represents the hydrolysis of salt (WZ):  $WZ + H_2O \rightarrow WOH + H^+ + Z^-$  –  
The pH of the solution is ...

- a) 12    b) 9    c) 7    d) 4

**33)** Which of the following salts produces an acidic solution upon hydrolysis?

- a) NaCl    b) NaHCO<sub>3</sub>    c) NH<sub>4</sub>Cl    d) NH<sub>4</sub>CH<sub>3</sub>COO

**34)** Which salt's hydrolysis gives a basic solution?

- a) NH<sub>4</sub>Cl    b) NaHCO<sub>3</sub>    c) NaCl    d) NH<sub>4</sub>HCO<sub>3</sub>

**35)** The solution from hydrolysis of sodium bicarbonate is basic because ...

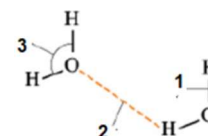
- a)  $[H^+] < [OH^-]$     b)  $[H^+] > [OH^-]$     c)  $[H^+] = [OH^-]$     d)  $[H^+] \leq [OH^-]$

**36)** The solution from hydrolysis of ammonium chloride is acidic because ...

- a)  $[OH^-] < [H^+]$     b)  $[OH^-] > [H^+]$     c)  $[OH^-] = [H^+]$     d)  $[OH^-] \leq [H^+]$

**37)** Which figure bond causes the high boiling point of water?

- a) (1)    b) (2)    c) (3)



**38)** The density of water is 1 g/cm<sup>3</sup> at 4 °C. This means that:

- a) 1 cm<sup>3</sup> = 1 kg    b) 1 cm<sup>3</sup> = 1 g    c) 1 m<sup>3</sup> = 1 g    d) 1 cm<sup>3</sup> = 1 L

**39)** The maximum density of pure water occurs at ...

- a) 0 °C    b) 4 K    c) 90 °C    d) 277 K

**40)** Three cups contain water of different salinities (same temp). An egg floats differently in each. The order of densities is:

- a) X = Y = Z    b) X > Y > Z    c) Z > Y > X    d) Z > Y = X



**50)** When temperature changes, how do volume and density of water vary?

- a) Increase – Increase    b) Decrease – Decrease  
c) Decrease – Increase    d) Increase – Decrease



**51)** The density of water  $1 \text{ g/cm}^3$  at  $4^\circ\text{C}$  is equivalent to ...

- a)  $0.001 \text{ kg/m}^3$     b)  $1 \text{ kg/m}^3$     c)  $4 \text{ kg/m}^3$     d)  $1000 \text{ kg/m}^3$

**52)** The relative density of seawater = 1.025  $\rightarrow$  its density equals:

- a)  $1.025 \text{ g/cm}^3$  &  $1.025 \text{ kg/m}^3$   
 b)  $1025 \text{ g/cm}^3$  &  $1025 \text{ kg/m}^3$   
 c)  $1.025 \text{ g/cm}^3$  &  $1025 \text{ kg/m}^3$   
 d)  $1025 \text{ g/cm}^3$  &  $1.025 \text{ kg/m}^3$

**53)** The density of water =  $1 \text{ g/cm}^3$  at  $4^\circ\text{C}$ , so volume of 4 kg water = ...

- a)  $0.004 \text{ m}^3$     b)  $1 \text{ m}^3$     c)  $4 \text{ m}^3$     d)  $4000 \text{ m}^3$

**54)** A sample has density =  $1 \text{ g/cm}^3 \rightarrow$  it's distilled water at ...

- a)  $23^\circ\text{C}$     b)  $8^\circ\text{C}$     c)  $4^\circ\text{C}$     d)  $0^\circ\text{C}$

**55)** In a hydrometer scale:

- a) Lower = 0    b) Upper = 0    c) Lower = lowest density    d) Upper = lowest density

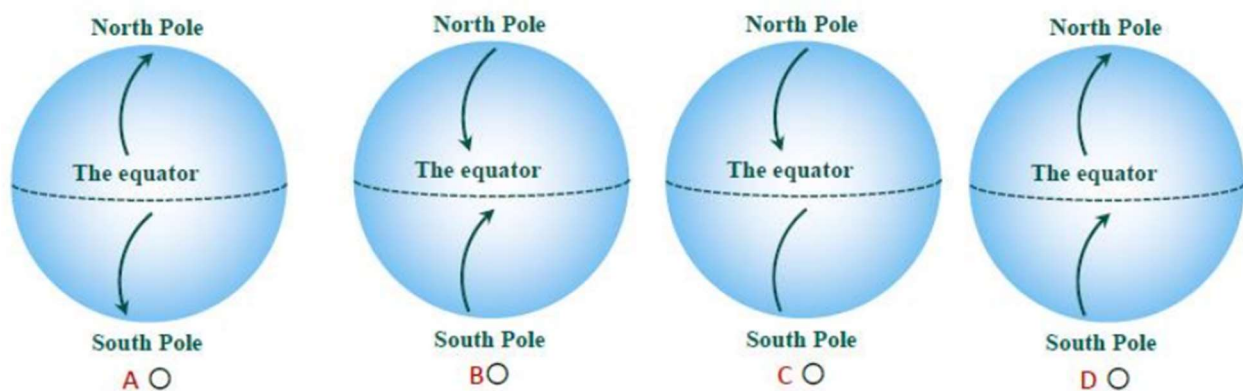
**56)** Hydrometer parts: function of wide cavity / mercury:

- a) Floating / Vertical balance    b) Floating / Floating  
 c) Vertical balance / Floating    d) Vertical balance / Vertical balance

**57)** In a hydrometer, density of liquid is very high when ...

- a) Immersed part  $\uparrow$     b) Immersed part  $\downarrow$     c) Adhesion  $\downarrow$     d)  $T \uparrow$

**58)** Diagram showing correct heat + salt water current directions?



**59)** Ocean currents: the direction for Heat transport and Nutrient transport?

- a) Poles  $\rightarrow$  Equator / Surface  $\rightarrow$  Bottom  
 b) Poles  $\rightarrow$  Equator / Bottom  $\rightarrow$  Surface  
 c) Equator  $\rightarrow$  Poles / Bottom  $\rightarrow$  Surface  
 d) Equator  $\rightarrow$  Poles / Surface  $\rightarrow$  Bottom

60) Average kinetic energy of water molecules is largest at ...

- a) 0 °C   b) 50 °C   c) 80 °C   d) 100 °C

61) Which affects the specific heat of a substance?

- a) Physical state   b) Mass   c) Volume   d) Heat quantity

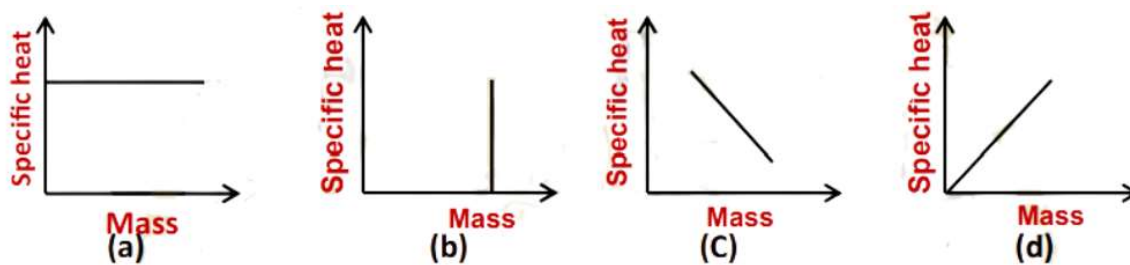
62) Deep ocean pressure effect on water density:

- a) No effect (water incompressible)   b) Increases but cancelled by cold T  
c) Decreases (bonds break)   d) Slight increase (compression)

63) Thermal energy flows from A → B means ...

- a) A has higher specific heat than B   b) Mass difference causes it  
c) A has less internal energy than B   d) A has higher temperature than B

64) Correct relation between mass and specific heat

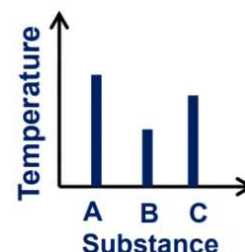


65) Three substances have the same mass and same initial temperature heated equally, sort the specific heat of these substances:

- a)  $B < C < A$    b)  $A < C < B$    c)  $C < B < A$    d)  $A < B < C$

66) Poikilotherms are .....

- (a) Birds + Mammals   (b) Fish, Amphibians, Reptiles  
(c) Humans, Whales   (d) Arthropods



67) Given specific heat of a group of different substances W,X,Y,Z are:

$W=450$ ,  $X=385$ ,  $Y=897$ ,  $Z=130$  (J/kg·K).

Which shows highest  $\Delta T$  when heated equally?

- a) W   b) X   c) Y   d) Z

68) Absolute zero = ...

- a) 0 K   b) 273 K   c) 0 °C   d) 273 °C

69) 37 °C = ... K

- a) 37 K   b) 273 K   c) 300 K   d) 310 K



**70)** Specific heat of glass =  $840 \text{ J/kg}\cdot^\circ\text{C} \rightarrow \dots \text{ J/kg}\cdot\text{K}$

- a)  $3.08 \text{ J/kg}\cdot\text{K}$       b)  $567 \text{ J/kg}\cdot\text{K}$       c)  $840 \text{ J/kg}\cdot\text{K}$       d)  $1113 \text{ J/kg}\cdot\text{K}$

**71)** When the same amount of heat was given to four samples of equal mass but of different materials, the following was observed: (temps rise are: W = 20, X = 40, Y = 60, Z = 80).

Highest specific heat?

- a) W      b) X      c) Y      d) Z

**72)** The density of water is equal to  $1\text{g/cm}^3$  at temperature  $4^\circ\text{C}$ , when the temperature is raised to  $8^\circ\text{C}$ , what happen to water volume and water density:

- a) increase / increase    b) decrease / decrease    c) decrease / increase    d) increase / decrease

**73)** Four samples of 1 kg mass — which has largest volume?

- a) Saltwater  $4^\circ\text{C}$     b) Saltwater  $8^\circ\text{C}$     c) Freshwater  $4^\circ\text{C}$     d) Freshwater  $8^\circ\text{C}$

**74)** Dissolving salt in pure water  $\rightarrow$  immersed hydrometer volume ...

- a) increase    b) decrease    c) no change    d) undetermined

**75)** Device measuring liquid density

- a) Hydrometer    b) Barometer    c) Manometer    d) Thermometer

**76)** Material used to balance hydrometer

- a) Mercury / Lead balls      b) Nickel / Chromium  
c) Platinum / Iridium      d) Bronze / Phosphorus

**77)** SI unit of temperature is

- a)  $^\circ\text{C}$       b)  $^\circ\text{F}$       c) K      d)  $^\circ\text{R}$

**78)** Freezing point of pure water is

- a)  $-273^\circ\text{C}$     b)  $273^\circ\text{C}$     c) 0 K      d) 273 K

**79)** Quantity measuring average kinetic energy of particles

- a) Heat      b) Temperature      c) Work      d) Mass

**80)** A certain amount of a substance whose temperature rises from  $30^\circ\text{C}$  to 310 K. then the change in temperature is

- a) 7 K      b)  $37^\circ\text{C}$       c) 280 K      d)  $280^\circ\text{C}$

**81)** The amount of heat required to raise the temperature of 0.9 kg of copper by  $70^\circ\text{C}$  equal ..... (The specific heat of copper equal  $385 \text{ J/Kg}\cdot\text{K}$ )

- a)  $2.43 \times 10^4 \text{ J}$     b)  $1.19 \times 10^5 \text{ J}$       c)  $4.14 \times 10^4 \text{ J}$     d)  $2.03 \times 10^5 \text{ J}$

**82)** Two equal masses from different metals (A) and (B) are heated by the same amount of heat; the temperature of (A) increased by  $50^{\circ}\text{C}$  while the temperature of metal (B) increased by  $150^{\circ}\text{C}$ . If the specific heat of (A) =  $390\text{ J/kg}\cdot\text{C}$ , then the specific heat of (B) = .....

- a) 130      b) 260      c) 390      d) 520

**83)** Heat ( $Q_{\text{th}}$ ) is ...

- a) Energy transfer due to a temperature difference  
b) Hot or cold state  
c) Average latent energy in bonds  
d) Total thermal energy

**84)** The concept "latent" refers to .....

- a) The heat is only absorbed when the substance is impure.  
b) The heat is hidden because it causes a significant change in pressure.  
c) The heat is absorbed or released without a change in temperature ( $\Delta T=0$ ).  
d) The heat can only be measured using an indirect method

**85)** If pure water freezes at  $0^{\circ}\text{C}$ , dissolving salt in water causes its freezing point to become ...

- a) less than  $0^{\circ}\text{C}$     b) equal to  $0^{\circ}\text{C}$     c) greater than  $0^{\circ}\text{C}$     d) between  $0^{\circ}\text{C}$  and  $4^{\circ}\text{C}$

**86)** Two liquids X and Y are separated by a semipermeable membrane. If the boiling point of X > boiling point of Y, water ...

- a) moves from X to Y    b) remains stationary  
c) moves from Y to X    d) moves both ways equally

**87)** Colligative properties of a solution ...

- a) Depend only on solute type      b) Depend only on solvent type  
c) Depend on type & concentration    d) Depend on concentration, not type

**88)** If the boiling point of water at the base of a mountain is  $100^{\circ}\text{C}$ , its boiling point at the top is

- a)  $95^{\circ}\text{C}$     b)  $120^{\circ}\text{C}$     c) 373 K    d) 0 K

**89)** As freezing point of a solution increases, osmotic pressure ...

- a) increases    b) decreases    c) does not change    d) becomes zero

**90)** If atmospheric pressure = 1 atm, boiling point of a liquid at 0.8 atm is ...

- a) equal    b) lower    c) higher    d) any of the above

**91)** Decreasing which of the following increases vapor pressure?

- a) Number of solvent molecules      b) Number of solute particles  
c) Temperature      d) Boiling point



**92)** Three equal solutions X, Y, and Z have different NaCl amounts (X=50 g, Y=10 g, Z=80 g).

The correct order of freezing points is ...

- a)  $T_x > T_y > T_z$     b)  $T_x = T_y = T_z$     c)  $T_y > T_x > T_z$     d)  $T_y < T_x < T_z$

**93)** Dissolving table salt in distilled water makes osmotic pressure ...

- a) increase    b) decrease    c) zero    d) constant

**94)** When water is left exposed and evaporates, its boiling point ...

- a) decreases    b) becomes zero    c) increases    d) doesn't change

**95)** Salt is sprinkled on icy roads ...

- a) To lower melting point    b) To raise melting point  
c) To reduce evaporation    d) To reduce vapor pressure

**96)** Freezing point decrease is ..... proportional to solute particles, while boiling point increase is ..... proportional to concentration.

- a) direct / direct    b) direct / inverse    c) inverse / inverse    d) inverse / direct

**97)** Concentration of a solution expresses ...

- a) total volume    b) solute & solvent type  
c) solute amount per solvent volume    d) temperature

**98)** Which is *not* an aqueous solution?

- a) Salt in water    b) Lemon juice    c) Tea    d) Sand + water

**99)** Why are water molecules less likely to evaporate in solutions?

- a) Because of the attractive forces between water molecules increases  
b) Because of the attractive forces between water molecules decreases  
c) Because of the attractive forces between water molecules and the solute increases  
d) Because of the attractive forces between water molecules and the solute decreases

**100)** Relationship between solute molecules and vapor pressure ...

- a) inverse    b) direct    c) none    d) variable

**101)** Colligative properties depend on ...

- a) Solvent    b) Solute type    c) Volume    d) Number of solute particles

**102)** Which increase leads to lower vapor pressure?

- a) Temperature    b) Freezing point    c) Solvent molecules    d) Solute particles

**103)** Increasing solute concentration affects vapor pressure ...

- a) increases    b) decreases    c) vanishes    d) constant

**104)** A liquid boils when its vapor pressure is ..... The atmospheric pressure.

- a) greater than      b) three times      c) less      d) equal to

**105)** Which factor doesn't affect boiling point?

- a) Volume      b) Density      c) Pressure      d) Concentration

**106)** A malfunction in the mitochondria of a cell would directly result in:

- a) Stopping protein synthesis  
b) A decrease in ATP production  
c) Failure of cell division  
d) Stopping transpiration

**107)** What is the most abundant chemical substance in living organisms?

- a) Oxygen      b) Carbon      c) Water      d) Glucose

**108)** If the nuclear membrane of a eukaryotic cell is removed, that cell would most closely resemble:

- a) Bacteria      b) Protists      c) Fungi      d) Multicellular algae

**109)** In prokaryotic cells, the genetic material is:

- a) Inside a nucleus      b) Free in the cytoplasm      c) Inside mitochondria      d) In the cell wall

**110)** Which of the following is a catabolic process?

- a) Photosynthesis      b) Protein synthesis      c) Cellular respiration      d) DNA replication

**111)** Enzymes stop working when:

- a) The temperature or pH is too far from the optimum level  
b) There is more substrate available  
c) Mitochondria increase in number  
d) The cell produces more ATP

**112)** All eukaryotic cells share the presence of which of the following?

- a) A large vacuole      b) mitochondria  
c) A cell wall      d) chloroplasts

**113)** Which structures are present in both a human skin cell and a leaf cell of a corn plant?

- a) Nucleus and cytoplasm.  
b) Plasma membrane and large vacuole.  
c) Nucleus and plastid.  
d) Plasma membrane and cell wall.



**114)** Which type of cell possesses a large sap vacuole?

- a) A cell in bean plant.
- b) Bacterial cell.
- c) Fungal cell.
- d) Hepatic cell.

**115)** Which of the following is an inorganic molecule?

- a) Carbohydrates
- b) Water
- c) Proteins
- d) Lipids

**116)** The percentage of water found in the blood plasma and other body fluids of mammals is about:

- a) 23%
- b) 47%
- c) 70%
- d) 83%

**117)** Which of the following correctly matches anabolic and catabolic processes, respectively?

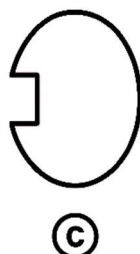
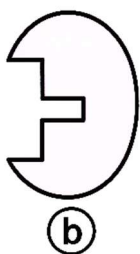
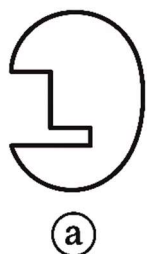
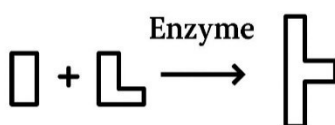
- a) Oxidation process / Reduction process
- b) Consuming energy / Producing energy
- c) Producing energy / Consuming energy
- d) Breaking down of chemical bonds / Formation of chemical bonds

**118)** Which of the following are products of glucose breakdown?

- a) O<sub>2</sub> and energy
- b) O<sub>2</sub> and water
- c) CO<sub>2</sub> and O<sub>2</sub>
- d) Water and CO<sub>2</sub>

**119)** The following figures show a chemical reaction.

Which of the figures represents the enzyme in this reaction?



**120)** Which of the following best explains why the reaction rate remains constant after a certain period even that an enzyme is present?

- a) The concentration of the enzyme increases.
- b) The enzyme's active sites become saturated with substrate molecules.
- c) The concentration of the substrate increases.
- d) The number of active sites on the enzyme increases.

**121)** If an enzyme is taken from bacteria that live in hot acidic springs where the temperature can reach up to 90°C, which of the following would cause the enzyme to stop functioning?

- a) Increasing the substrate concentration
- b) Increasing the enzyme concentration
- c) Raising the pH level of the medium
- d) Lowering the surrounding temperature to 80°C

### Essay Questions

**1)** Explain the main processes and nature of the water cycle.

→ The **hydrological (water) cycle** is an almost closed system where water continuously changes between solid, liquid, and gas states through **evaporation, condensation, precipitation, and infiltration**. It reshapes Earth physically, chemically, and biologically.

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**2)** What biological processes take part in the water cycle?

→ **Transpiration, respiration, and excretion** are biological activities that release or move water vapor and wastes, supporting the continuity of the cycle.

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**3)** Describe transpiration and its importance for plants.

→ **Transpiration** is when plants release excess water vapor through stomata. It cools the plant and creates a suction that draws water and minerals from roots upward via xylem.

→ If transpiration stops, plants can't transport nutrients efficiently and may overheat.

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**4)** Define excretion and give examples.

→ **Excretion** is the removal of metabolic wastes like CO<sub>2</sub>, water vapor, and nitrogenous substances (ammonia, urea, uric acid).



5) Define the environment, its components, and main spheres.

→ The **environment** includes everything surrounding living organisms — both **biotic** (humans, plants, animals, microorganisms) and **abiotic** (air, water, light, soil) factors.

→ It's organized into four interacting **spheres: Hydrosphere, Atmosphere, Lithosphere, and Biosphere**, all affecting and being affected by human activity.

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6) Give Reason – Water is considered a polar solvent.

→ Because oxygen has a higher electronegativity than hydrogen, so bond electrons are attracted toward oxygen forming a partial negative charge on it and a partial positive charge on hydrogen; this polarity enables water to dissolve many salts and polar compounds.

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7) Give Reason – The boiling point of water is high even though it is a covalent compound.

→ Because each water molecule forms hydrogen bonds with neighboring molecules, creating a network that requires a large amount of energy to break, so water's boiling point reaches 100 °C while similar compounds like H<sub>2</sub>S boil at –61 °C.

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8) Give Reason – Dissolving table salt (NaCl) in water.

→ Water molecules surround Na<sup>+</sup> and Cl<sup>–</sup> ions because the negative oxygen ends attract Na<sup>+</sup> and the positive hydrogen ends attract Cl<sup>–</sup>; ions separate and remain hydrated, so dissolution is not hydrolysis since no acid or base is formed.

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9) Explain the hydrolysis of salts (NH<sub>4</sub>Cl, NaHCO<sub>3</sub>, NH<sub>4</sub>HCO<sub>3</sub>).

→ • **Ammonium chloride (NH<sub>4</sub>Cl)**: Hydrolysis increases [H<sup>+</sup>] and decreases [OH<sup>–</sup>]; solution becomes acidic (pH < 7).

→ • **Sodium bicarbonate (NaHCO<sub>3</sub>)**: Hydrolysis decreases [H<sup>+</sup>] and increases [OH<sup>–</sup>]; solution becomes basic (pH > 7).

→ • **Ammonium bicarbonate (NH<sub>4</sub>HCO<sub>3</sub>)**: Hydrolysis does not change [H<sup>+</sup>] and [OH<sup>–</sup>]; solution remains neutral (pH = 7).

---

10) Define and explain the pH scale and neutral, acidic, and basic solutions.

→ The pH scale expresses acidity or alkalinity of solutions from 0 to 14. When [H<sup>+</sup>] = [OH<sup>–</sup>], the solution is neutral (pH = 7). When [H<sup>+</sup>] > [OH<sup>–</sup>], it is acidic (pH < 7). When [H<sup>+</sup>] < [OH<sup>–</sup>], it is basic (pH > 7).

11) Compare between hydrolysis of different salts ( $\text{NaHCO}_3$ ,  $\text{NH}_4\text{HCO}_3$ ,  $\text{NH}_4\text{Cl}$ ).

|              | Ion Change                                           | Resulting Solution                   | Example                                                                                                 |
|--------------|------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------------------------|
| Acidic salt  | $\uparrow [\text{H}^+]$ , $\downarrow [\text{OH}^-]$ | Acidic ( $\text{pH} < 7$ )           | $\text{NH}_4\text{Cl} + \text{H}_2\text{O} \rightarrow \text{NH}_4\text{OH} + \text{H}^+ + \text{Cl}^-$ |
| Basic salt   | $\uparrow [\text{OH}^-]$ , $\downarrow [\text{H}^+]$ | Basic / Alkaline ( $\text{pH} > 7$ ) | $\text{NaHCO}_3 + \text{H}_2\text{O} \rightarrow \text{Na}^+ + \text{OH}^- + \text{H}_2\text{CO}_3$     |
| Neutral salt | No net change in $[\text{H}^+]$ or $[\text{OH}^-]$   | Neutral ( $\text{pH} = 7$ )          | $\text{NH}_4\text{HCO}_3 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3 + \text{NH}_4\text{OH}$ |

12) Explain how density of water changes with temperature and salinity.

→ As temperature decreases from 100 °C to 4 °C, density increases because molecules move closer; below 4 °C it decreases due to hydrogen bond arrangement. Dissolving salts increases density because dissolved ions increase total mass per unit volume.

13) Describe the principle and structure of the hydrometer.

→ The hydrometer measures liquid density based on buoyancy law: a floating sealed glass tube with a wide lower part filled with lead or mercury balls for vertical balance, and a narrow graduated stem. It sinks less in denser liquids; the lower scale marks higher density.

14) Define heat, temperature, and specific heat, and relate them.

→ *Heat* is energy transferred due to a temperature difference, measured in Joules.

*Temperature* measures the average kinetic energy of molecules, in Kelvin.

*Specific heat* is heat needed to raise 1 kg of a substance by 1 K

water's high specific heat makes it resist rapid temperature change.

15) Define latent heat of vaporization and explain its importance.

→ The latent heat of vaporization is the thermal energy absorbed by 1 kg of a liquid to convert it to vapor at constant temperature.

Water's high latent heat (from hydrogen bonds) allows sweating and transpiration to cool organisms.

16) Explain why ice floats and why water is ideal for aquatic life.

→ Ice has lower density than liquid water because its molecules form an open hexagonal structure with wider spacing. Thus, ice floats and insulates the water below, keeping it liquid and allowing organisms to survive under frozen surfaces.



**17)** Explain why coastal areas have moderate climate.

→ Water's high specific heat causes it to absorb much heat with little temperature rise by day and release it slowly at night, moderating temperature near seas and oceans (sea breeze effect).

---

**18)** Compare cold-blooded and warm-blooded organisms.

→ Cold-blooded (fish, reptiles, amphibians, invertebrates) depend on surrounding temperature; warm-blooded (birds, mammals) maintain constant body temperature metabolically. Water's thermal stability protects poikilotherms in deep oceans.

---

**19)** A quantity of pure water with a mass of 1 kg and a temperature of 8 °C. What happens to its density in each of the following cases:

**First:** Adding 1 kg of pure water at a temperature of 8 °C to it?

→ Its density does not change (same substance, same temperature).

**Second:** Dissolving 34 g of table salt in it?

→ Its density increases (dissolved salts increase density).

---

**20)** Calculate the final temperature of the mixture formed from mixing 100 kg of water at 50 °C with 250 kg of water at 50 °C.

→ 50 °C

---

**21)** A kettle holds 1.5 kg of liquid water at 50 °C. How much heat energy (Q) must be supplied to bring the water to its boiling point (100 °C)? ( $c = 4180 \text{ J/kg}\cdot\text{K}$ )

→  $Q = m c \Delta t = 1.5 \times 4180 \times 50 = 313\,500 \text{ J}$

---

**22)** Give reason: When a molten cake is taken out immediately from the oven, we perceive the chocolate to be much hotter than the cake.

→ Chocolate has a lower specific heat than the cake, so it reaches a higher temperature with the same heat.

---

**23)** Give reason: Farmers in cold areas spray fruit trees with water.

→ The water freezes on the surface forming ice that acts as an insulating layer, reducing heat loss.

---

**24)** Give reason: When two equivalent masses of aluminum and water are exposed to the same quantity of heat, the temperature of aluminum rises more.

→ Aluminum has a lower specific heat than water.

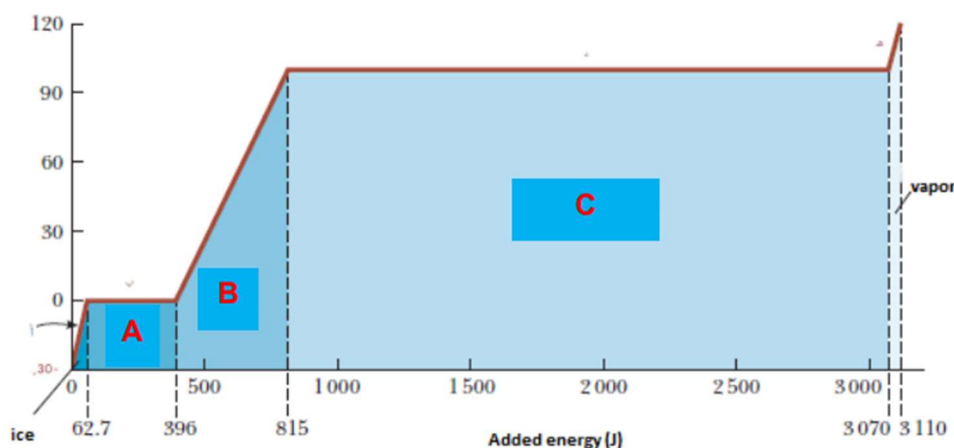
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**25)** Give reason: The time required for water is higher than that required for another substance with the same mass to increase their temperature by the same amount.

→ Because water's specific heat is high, it needs more heat and more time to raise its temperature.

---

**26)** The graph represents the relation between temperature and added energy to water starting from ice at  $-30^{\circ}\text{C}$  until becoming vapor above  $100^{\circ}\text{C}$ . Identify the state of water at each of the stages A, B, and C.



→ A: Melting stage at  $0^{\circ}\text{C}$  (ice + water)

→ B: Liquid water heating from  $0^{\circ}\text{C}$  to  $100^{\circ}\text{C}$  (liquid)

→ C: Boiling at  $100^{\circ}\text{C}$  (water changes to vapor; liquid + vapor)

---

**27)** Define vapor pressure of a solution.

→ Vapor pressure is the pressure exerted by vapor molecules formed above a liquid in a closed system when the rate of evaporation equals the rate of condensation at a certain temperature.

---



**28)** What happens to the boiling point of an aqueous solution when going up a mountain, and why?

→ The boiling point decreases because air pressure acting on the water surface decreases with altitude; a lower pressure requires less energy for vapor molecules to escape.

---

**29)** Give reason: Pure water evaporates faster than aqueous solutions.

→ In a solution, solute molecules occupy surface positions and form attractions with water molecules, reducing the number of water molecules that can escape into vapor and lowering the vapor pressure.

---

**30)** Give reason: The boiling point of a solution is higher than that of pure water.

→ Dissolving solute decreases vapor pressure, requiring more energy for vaporization; therefore, the boiling point increases proportionally with solute concentration.

---

**31)** Give reason: The freezing point of a solution is lower than that of pure water.

→ Solute molecules hinder the ability of water molecules to form ice crystals, lowering the freezing point under normal pressure.

---

**32)** Give reason: When salt is spread on icy roads in winter.

→ The salt dissolves in surface water, lowering its freezing point and preventing ice formation, thus reducing car skidding.

---

**33)** Give reason: Water moves through a semipermeable membrane from dilute to concentrated solutions.

→ Due to osmosis, water moves from a region of lower solute concentration (low osmotic pressure) to higher solute concentration (high osmotic pressure) until equilibrium is reached.

---

**34)** Why do Bacteria belong to prokaryotes, but Protozoa belong to eukaryotes?

→ Bacteria are prokaryotes because their genetic material is not surrounded by a nuclear membrane and they have a cell wall containing a substance called peptidoglycan that gives them shape and rigidity.

→ Protozoa are eukaryotes because their genetic material is enclosed by a nuclear membrane and they contain specialized organelles such as mitochondria and plastids.

---

**35)** Why is the cell wall of bacteria characterized by containing peptidoglycan?

→ The cell wall in bacteria contains peptidoglycan that gives the bacterial cell shape and rigidity, protecting it from physical damage and preventing the cell from bursting when water moves into it.

---

**36)** Why does the Nucleus determine the traits and control all living cell activities?

→ The nucleus is located inside the cell and controls the cell's activities because it contains the genetic material that determines the organism's traits. It is found in both plant and animal cells.

---

**37)** Why does the Cytoplasm have an important role in the survival of the living cell?

→ The cytoplasm is a gel-like substance mostly composed of water, containing important chemicals necessary for the cell's survival. It is the medium in which vital activities and biochemical processes take place, allowing organelles to function properly.

---

**38)** Why does Water act as a universal solvent and help keep the body's internal temperature stable?

→ Water is described as a universal solvent because it allows biochemical reactions to occur by dissolving mineral salts and nutrients and carrying gases such as oxygen and carbon dioxide to facilitate their transport inside the organism and the removal of wastes out of it.

→ Due to the high specific heat of water, it helps living organisms maintain stable internal temperatures despite fluctuations in the external environment.



Lesson 6: Biological Adaptations **Key Concepts**

- ◆ **Adaptation** — Traits (structural, behavioral, physiological) that help organisms survive in their environments.
- ◆ **Structural (Anatomical) Adaptation** — Change in body structure or shape that helps survival.
- ◆ **Behavioral Adaptation** — Learned or inherited behaviors that help organisms face conditions or use resources.
- ◆ **Physiological (Functional) Adaptation** — Changes in how vital functions work to support survival.
- ◆ **Osmotic Pressure Rule** — Water moves from lower concentration (lower osmotic pressure) to higher concentration (higher osmotic pressure).

 **Comparison / Relationship Tables****Structural Adaptations of Fish**

| Feature                   | Function                                               |
|---------------------------|--------------------------------------------------------|
| Streamlined body          | Reduces water resistance                               |
| Fins                      | Help locomotion                                        |
| Scales + mucus            | Protection + reduce resistance                         |
| Gills                     | Extract dissolved oxygen from water                    |
| Swim bladder (bony fish)  | Help them float in water (buoyancy)                    |
| Strong arteries and veins | To tolerate very high external pressure without damage |

**Special Structural Adaptations of Deep-Sea Fish**

| Feature           | Purpose                                     |
|-------------------|---------------------------------------------|
| Large eyes        | Seeing in darkness                          |
| Compressed body   | Withstand very high pressure (Icelfish)     |
| Flexible skeleton | Survive extreme depth pressure (Viper fish) |

**Structural Adaptations of Dolphins**

| Feature                   | Function                             |
|---------------------------|--------------------------------------|
| Streamlined shape         | Easy swimming                        |
| Fins instead of legs      | Movement in water                    |
| Breathing opening on head | Breathing atmospheric air at surface |

**Behavioral Adaptation Examples**

| Behavior         | Organism | Function                      |
|------------------|----------|-------------------------------|
| Sound production | Whales   | Communication + hunting       |
| Migration        | Salmon   | Reproduction + survival cycle |

## Salmon Life Journey

| Stage          | Description                                                            |
|----------------|------------------------------------------------------------------------|
| Birth          | Eggs hatch in fresh water, and young salmon live there first.          |
| Juvenile Stage | Young adapt to freshwater environment before leaving.                  |
| Adult Stage    | Juvenile salmon migrate to the sea and spend most of adult life there. |
| Reproduction   | Mature salmon return to the river where they were born to reproduce.   |

## Physiological Adaptations in Deep-Sea Fish

| Adaptation                    | Function                                                  |
|-------------------------------|-----------------------------------------------------------|
| Slow metabolic rate           | Reduce oxygen needs in oxygen-deficient conditions deeply |
| Blood pressure regulation     | Match external pressure at great depths                   |
| High hemoglobin concentration | Adapt to decreased oxygen levels (Viper fish)             |

## Osmoregulation of Freshwater Organisms

| Organism                                  | How They Remove Excess Water             |
|-------------------------------------------|------------------------------------------|
| Unicellular (amoeba, paramecium, euglena) | Contractile vacuole removes excess water |
| Fish                                      | Kidneys excrete diluted urine            |

## Osmoregulation of Saltwater Organisms

| Organism       | How They Maintain Water Balance                                               |
|----------------|-------------------------------------------------------------------------------|
| Saltwater fish | Swallow seawater + excrete salts via kidneys & gills                          |
| Sharks         | Retain high urea → osmotic pressure becomes near seawater → reduce water loss |

 Q & A Section

? Where do Viperfish live?

 In tropical regions of the major oceans.

? Where do Icefish live?

 In cold southern oceans at depths up to 2000 meters.

? Where do salmon spend most adult life?

 In the sea, after leaving freshwater where they were born.

 Common Mistakes & Exam Traps

-  Confusing structural adaptations (body form) with physiological adaptations (body functions).
-  Believing freshwater and saltwater organisms use the same method to control water.
-  Assuming all aquatic animals breathe through gills — dolphins breathe air.
-  Thinking migration is the only adaptation of salmon, it also has structural and physiological adaptations.



### Lesson 7: Effect of Atmospheric Air Gases on Aquatic Environments

#### Key Concepts

- ◆ **Solubility** — ① Ability of a solute to dissolve in a solvent to form a homogeneous solution at specific temperature and pressure.  
— ② Maximum amount of solute required in a certain volume of solvent to form a saturated and stable solution at specific temperature and pressure.
- ◆ **Diffusion of CO<sub>2</sub>** — CO<sub>2</sub> moves from higher concentration outside cells to lower concentration inside cells.
- ◆ **Temperature Effect** — Solubility of both gases decreases with increasing temperature; CO<sub>2</sub> decreases faster than O<sub>2</sub>.

#### Comparison / Relationship Tables

##### Sources of Oxygen in Aquatic Environments

| Item                                  | Fact                                             |
|---------------------------------------|--------------------------------------------------|
| Atmospheric air<br>→ Waves & currents | Main source; oxygen slightly soluble in water.   |
|                                       | Increase dissolution by increasing gas exchange. |
| Aquatic plants & algae                | Produce oxygen through photosynthesis.           |

##### Sources of Carbon Dioxide in Aquatic Environments

| Item             | Fact                                                      |
|------------------|-----------------------------------------------------------|
| Atmosphere       | CO <sub>2</sub> exchanged between air and water.          |
| Marine organisms | Produce CO <sub>2</sub> as a metabolic waste.             |
| Human activities | Pollution and decomposition add CO <sub>2</sub> to water. |

##### Temperature and Solubility Relationship

| Gas             | Effect of Higher Temperature                      |
|-----------------|---------------------------------------------------|
| O <sub>2</sub>  | Solubility decreases.                             |
| CO <sub>2</sub> | Solubility decreases faster than O <sub>2</sub> . |

##### Roles of Gases in Biological Processes

| Gas            | Biological Role                                                                                                                                                  |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Oxygen         | Oxidizes glucose during cellular respiration (catabolism).                                                                                                       |
| Carbon dioxide | Essential for forming carbohydrates such as glucose during photosynthesis                                                                                        |
|                | $6\text{CO}_2 + 12\text{H}_2\text{O} \xrightarrow{\text{chlorophyll / Sunlight}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{H}_2\text{O} + 6\text{O}_2 \uparrow$ |

##### Comparing O<sub>2</sub> and CO<sub>2</sub> Solubility

| Item                                                          | Value / Observation                                           |
|---------------------------------------------------------------|---------------------------------------------------------------|
| O <sub>2</sub> in <u>air</u> vs CO <sub>2</sub> in <u>air</u> | O <sub>2</sub> is 500× <i>higher</i> in concentration.        |
| O <sub>2</sub> in <u>water</u> vs CO <sub>2</sub>             | O <sub>2</sub> solubility is 50× <i>less</i> .                |
| Saltwater                                                     | Both gases are 20–30% <i>less</i> soluble than in freshwater. |

## Effects of Increasing Dissolved Oxygen

| Effect            | Result                                         |
|-------------------|------------------------------------------------|
| Respiration       | Improves ability of organisms to breathe.      |
| Metabolism        | Supports growth and biological processes.      |
| Activity          | Increases swimming, hunting, and reproduction. |
| Ecosystem balance | Maintains diverse, stable aquatic life.        |

Effects of Increasing CO<sub>2</sub> in Water

| Effect                      | Description                                                                                       |
|-----------------------------|---------------------------------------------------------------------------------------------------|
| Acidification               | Forms carbonic acid H <sub>2</sub> CO <sub>3</sub> ; lowers pH; harms especially eggs and larvae. |
| Impairing Respiration       | Reduces dissolved oxygen needed for breathing.                                                    |
| Weakening external skeleton | CaCO <sub>3</sub> converts to soluble Ca(HCO <sub>3</sub> ) <sub>2</sub> ; reduces calcification. |
| Weakening internal skeleton | Affects calcium balance and slows growth.                                                         |

## Types of Support Structures

| Type             | Example                                               | Fact                                                    |
|------------------|-------------------------------------------------------|---------------------------------------------------------|
| External support | corals (from Cnidarians)<br>oysters (from mollusks)   | Provides protection and support; made by calcification. |
| External support | Shrimp                                                | External skeleton made of chitin.                       |
| Internal support | Fish and marine mammals<br>(like dolphins and whales) | Skeleton contains calcium phosphate + collagen.         |

Effects of Decreasing CO<sub>2</sub> in Water

| Effect               | Result                                                         |
|----------------------|----------------------------------------------------------------|
| Lower photosynthesis | Less sugar formation such as glucose → weak energy production. |
| Food chain impact    | Less energy in producers limits energy for higher levels.      |
| pH imbalance         | pH increases; harms species adapted to specific pH.            |

 Q & A Section

**? Why does acidification strongly affect eggs and larvae?**

 Their early stages are highly sensitive to pH changes.

**? Why does dissolved oxygen decrease when CO<sub>2</sub> increases?**

 High CO<sub>2</sub> lowers available dissolved oxygen needed for breathing.

 Common Mistakes & Exam Traps

-  Thinking oxygen dissolves easily in water; it dissolves only slightly.
-  Assuming O<sub>2</sub> and CO<sub>2</sub> decrease equally with temperature; CO<sub>2</sub> decreases faster.
-  High CO<sub>2</sub> convert calcium carbonate into calcium bicarbonate which is soluble in water.

Lesson 8: Effect of Light **Key Concepts**

- ◆ **Visible Light** — A small part of the electromagnetic spectrum consisting of spectrum colors from red to violet.
- ◆ **Electromagnetic Waves** — Waves with different wavelengths and frequencies that include visible light.
- ◆ **Solar Radiation Through Water** — Part absorbed by water, suspended materials, and plants; part scattered into deep.
- ◆ **Photic Zones** — Ocean layers formed as light intensity decreases with depth.
- ◆ **Light Absorption** — Almost all infrared absorbed at 10 cm depth; more than 50% of visible light absorbed at 10 m.
- ◆ **Color Penetration** — Warm colors (red/orange) absorbed; cool colors (blue/indigo/violet) scattered and penetrate deeper.

 **Comparison / Relationship Tables****Spectrum and Light Basics**

| Item            | Fact                                       |
|-----------------|--------------------------------------------|
| Visible light   | Small part of electromagnetic spectrum.    |
| Spectrum colors | Red → Violet in order (ROY-G-BIV).         |
| Wave property   | Colors differ in wavelength and frequency. |

**Light Absorption at Different Depths**

| Depth | Observation                              |
|-------|------------------------------------------|
| 10 cm | Almost all infrared absorbed.            |
| 10 m  | >50% of visible light absorbed.          |
| 100 m | ~1% visible light (mostly blue) reaches. |

**Electromagnetic spectrum**

| Region           | Wavelength | Frequency | Notes                |
|------------------|------------|-----------|----------------------|
| Gamma rays       | Shortest   | Highest   | Most energetic       |
| X-rays           | Very short | Very high |                      |
| Ultraviolet (UV) | Short      | High      | Above visible violet |
| Visible light    | Medium     | Medium    | See detailed table   |
| Infrared (IR)    | Long       | Low       | Heat radiation       |
| Microwaves       | Very long  | Very low  |                      |
| Radio waves      | Longest    | Lowest    | Lowest energy        |

**Colors**

| Color  | Wavelength       | Frequency  |
|--------|------------------|------------|
| Red    | Longest (700nm)  | Lowest     |
| Orange | Long             | Low        |
| Yellow | Medium-long      | Medium-low |
| Green  | Medium           | Medium     |
| Blue   | Short            | High       |
| Indigo | Very short       | Very high  |
| Violet | Shortest (400nm) | Highest    |



## Color Behavior in Water

| Color Type                | Behavior                     |
|---------------------------|------------------------------|
| Warm (red/orange)         | Absorbed quickly.            |
| Cool (blue/indigo/violet) | Penetrate deeper; scattered. |

## Photic Zones

| Zone     | Light Level | Adaptation                      |
|----------|-------------|---------------------------------|
| Sunlit   | High        | Many photosynthetic organisms.  |
| Twilight | Low         | Organisms adapted to dim light. |
| Dark     | None        | Organisms adapted to darkness.  |

## Factors Affecting Light Penetration

| Factor                  | Effect                                                                     |
|-------------------------|----------------------------------------------------------------------------|
| Sun angle (inclination) | Perpendicular rays → more penetration.<br>Inclined rays → more reflection. |
| Suspended materials     | Increase absorption & scattering.                                          |
| Water depth             | Light intensity decreases gradually.                                       |

## Distribution of Marine Organisms

| Organism Type            | Light Need | Distribution             |
|--------------------------|------------|--------------------------|
| Photosynthetic organisms | High       | Surface layers.          |
| Algae in clear water     | Moderate   | Grow down to 100 m.      |
| Algae in turbid water    | High       | Found closer to surface. |

## Role of Solar Radiation in Marine Life

| Effect            | Description                                                      |
|-------------------|------------------------------------------------------------------|
| Photosynthesis    | Basis of marine life.                                            |
| Temperature       | Controls distribution of organisms.                              |
| Coral reef growth | Radiation <u>in warm shallow water</u> supports symbiotic algae. |

## Temperature-Based Distribution Examples

| Water Type                                     | Examples         |
|------------------------------------------------|------------------|
| Warm tropical water (near equator)             | Tuna, barracuda. |
| Cooler non-tropical regions (far from equator) | Cod.             |

## Changes in Solar Radiation Intensity

| Situation          | Result                                                   |
|--------------------|----------------------------------------------------------|
| Polar winter       | Very low radiation (almost no sun) → low photosynthesis. |
| Low photosynthesis | Less food for marine organisms.                          |

## Solar Radiation and Ocean Currents

| Effect             | Observation                                                                            |
|--------------------|----------------------------------------------------------------------------------------|
| Forms currents     | Drives movement of ocean water.                                                        |
| Influences climate | <u>Gulf Stream</u> :<br>→ Moderates Western Europe climate<br>→ Enhances biodiversity. |

 Q & A Section

? Why does algae grow closer to the surface in turbid waters?

 Suspended materials reduce light, so algae stay closer to the sunlight.

? What happens when solar radiation warms tropical waters?

 It attracts fish that need specific warm temperatures to survive and reproduce.

 Common Mistakes & Exam Traps

-  Thinking light penetrates equally — warm colors are absorbed, blue penetrates deepest.
-  Not all plant grows near the surface — clear water allows deeper growth up to 100m.
-  Forgetting solar radiation affects both *photosynthesis* and *temperature*-based distribution.

Lesson 9: Effect of Water Pressure **Key Concepts**

- ◆ **Fluids** — Materials that flow; include liquids and gases.  
Gases compress easily, but liquids resist compression and keep nearly constant volume.
- ◆ **Pressure in Liquids** — Pressure at any point equals the weight of the liquid column above it; force on objects is perpendicular to their surface.
- ◆ **Force on Submerged Objects (Pressing force)** — Calculated by  $F = P \times A$  where P is the water pressure and A the exposed surface area.
- ◆ **Water Pressure** — Increases with depth (h) and with water density ( $\rho$ ).
- ◆ **Atmospheric Pressure** — At sea level equals 1 atm =  $1.013 \times 10^5$  N/m<sup>2</sup> at 0°C.
- ◆ **Pressure Increase with Depth** — Water pressure increases by about 1 atm for every 10 m; total pressure = atmospheric pressure + water pressure.

 **Comparison / Relationship Tables****Liquid Pressure Basics**

| Item                      | Fact                              |
|---------------------------|-----------------------------------|
| Cause of pressure         | Weight of water above point.      |
| Force direction           | Perpendicular to object surface.  |
| Density effect ( $\rho$ ) | Higher density → higher pressure. |
| Depth effect (h)          | More depth → higher pressure      |

**Atmospheric vs Water Pressure**

| Item               | Value / Fact                                   |
|--------------------|------------------------------------------------|
| Sea level pressure | 1 atm = $1.013 \times 10^5$ N/m <sup>2</sup> . |
| Depth increase     | +1 atm every 10 m.                             |
| Total pressure     | $P = P_a + P_{\text{water}}$ .                 |

**Organisms by Depth Level**

| Depth      | Characteristics / Adaptations                                                                            |
|------------|----------------------------------------------------------------------------------------------------------|
| Surface    | Low pressure → less strong structures.                                                                   |
| 200–1000 m | Gas-filled swim bladder for buoyancy and depth movement and migration from sea to river like for salmon. |
| 2000 m     | <u>Compact bodies, proteins &amp; fluids</u> withstand pressure<br>Many (e.g., rays) lack gas bladders.  |

**Swim Bladder Adaptations**

| Organism Type           | Feature                                                                         |
|-------------------------|---------------------------------------------------------------------------------|
| Intermediate-depth fish | Gas-filled bladder for balance and migration (salmon).                          |
| Deep fish               | Liquid-filled bladder or none; rely on large oil-rich liver for buoyancy (ray). |



**Bony vs Cartilaginous Skeletons**

| Type                                          | Example            | Fact                                                                       |
|-----------------------------------------------|--------------------|----------------------------------------------------------------------------|
| <b>Bony fish</b><br>(Osteichthyes)            | Tilapia,<br>mullet | Bone skeleton gives strong support under pressure.<br>Heavy + not flexible |
| <b>Cartilaginous fish</b><br>(Chondrichthyes) | Sharks,<br>rays    | Cartilage is lighter and more flexible than bone.<br>Light + Flexible      |

**Cell Membrane Adaptation**

| Item                       | Fact                                                    |
|----------------------------|---------------------------------------------------------|
| <b>Deep-sea fish cells</b> | High levels of unsaturated fatty acids.                 |
| <b>Result</b>              | Membranes stay fluid and stable under immense pressure. |

**Q & A Section**

**? Why do some rays have no gas bladder?**

**...** To prevent collapse under extreme pressure; body structure replaces buoyancy control.

**? How do deep fish stay buoyant without gas?**

**...** They use a liquid-filled bladder or large oil-rich liver to control depth.

**Common Mistakes & Exam Traps**

- ⚠** Thinking water pressure depends only on depth; density also increases pressure.
- ⚠** Forgetting total pressure includes both atmospheric and water pressure.
- ⚠** Assuming all fish have gas bladders; deep species often lack them (oil one instead).

## Questions

1. Which of the following do sea bottom fish do to adapt to the oxygen in their surrounding environment?

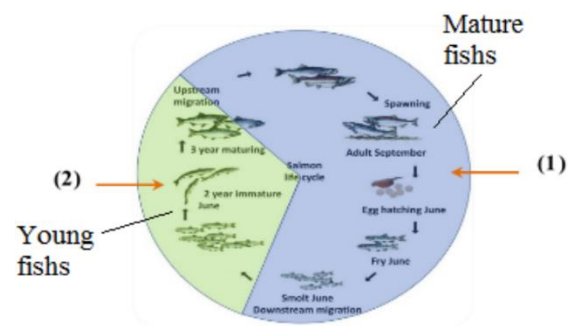
- a) Speed up their metabolism to reduce their oxygen demand
- b) Slow down their metabolism to consume more oxygen
- c) Speed up their metabolism to consume more oxygen
- d) Slow down their metabolism to reduce their oxygen demand

2. Salmon fish migration represents which adaptation...

- a) Behavioral only
- b) Physiological only
- c) Behavioral and physiological combined
- d) Not considered an adaptation

3. The figure shows the life cycle of salmon. Which of the following represents stages (1) and (2)?

- (1) → (2)
- a) River → Sea
- b) River → River
- c) Sea → Sea
- d) Sea → River



4. If the concentration of a saline solution (X) is greater than the concentration of a saline solution (Y), and a semipermeable membrane separates them, which moves due to osmosis?

- a) Salt from (X) to (Y)
- b) Salt from (Y) to (X)
- c) Water from (X) to (Y)
- d) Water from (Y) to (X)

5. Amoeba adapted to low osmotic pressure. Which component performs each function?

**Discharge excess water — Collect excess water from the cell**

- a) Contractile vacuole — Plasma membrane
- b) Plasma membrane — Plasma membrane
- c) Plasma membrane — Contractile vacuole
- d) Contractile vacuole — Contractile vacuole

**6. Amoeba and freshwater fish are similar in...**

- a) Cellular respiration
- b) Body complexity
- c) Gas exchange organ
- d) Osmoregulation methods

**7. Amoeba, Paramecium, and Euglena are similar in...**

- a) They contain pseudopods from the excess body
- b) The osmotic pressure outside equals the pressure inside
- c) The osmotic pressure outside is higher than inside
- d) They are multicellular organisms

**8. Ocean bottom bony fish are structurally adapted by having...**

- a) Swim bladder
- b) Kidneys
- c) A contractile vacuole
- d) Wide eyes

**9. Fish that live in salt water...**

- a) The osmotic pressure outside is lower than inside
- b) Water moves from their bodies to the outside
- c) They get rid of excess water through the contractile vacuole
- d) The osmotic pressure inside is lower than outside

**10. Sea fish face water salinity by:**

- a) Swallowing large quantities of water, controlling blood urea
- b) Kidneys eliminating excess salts in dilute urine
- c) Contractile vacuole
- d) Large gills

**11. The osmotic pressure in the bodies of freshwater fish is:**

- a) Low, causing them to lose water
- b) High, causing them to lose water
- c) Low, causing them to gain water
- d) High, causing them to gain water

**12. The osmotic pressure in saltwater fish is...**

- a) Low → leads to water loss
- b) High → leads to water loss
- c) Low → leads to water gain
- d) High → leads to water gain



**13. What type of adaptation does salmon have?**

- a) Physiological only
- b) Physiological and structural
- c) Physiological and behavioral
- d) Physiological, behavioral, and structural

**14. Which of the following are characteristics of deep-sea fish?**

Eyes — Body shape

- a) Wide — Compressed
- b) Wide — Flexible
- c) Narrow — Compressed
- d) Narrow — Flexible

**15. What is the importance of the swim bladder for bony fish?**

- a) Helps them float
- b) Improves oxygen extraction
- c) Reduces water resistance
- d) Enables them to withstand high pressure

**16. A 10% saline solution and a 15% sugar solution are separated by a semipermeable membrane. What happens?**

- a) Water moves from saline → sugar
- b) Water moves from sugar → saline
- c) Salt moves from saline → sugar
- d) Salt moves from sugar → saline

**17. Unicellular organisms such as Amoeba obtain oxygen and release CO<sub>2</sub> through:**

- a) Plasma membrane by diffusion
- b) Contractile vacuole by diffusion
- c) Plasma membrane by osmosis
- d) Contractile vacuole by osmosis

**18. It refers to the behavioral or physical traits of an organism that help it survive better in its ecosystem.**

- a) Transpiration
- b) Adaptation
- c) Respiration
- d) Excretion

19. Which of the following is a structural adaptation of the dolphin?

- a) Large-sized gills
- b) Large eyes
- c) Air bladder
- d) Breathing opening at the top of the head

20. Icefish lives in the cold Southern Oceans at depths of approximately...

- a) 2 km
- b) 20 km
- c) 200 km
- d) 2000 km

21. Whales use their ..... in communication and hunting.

- a) Body colors
- b) Sounds
- c) Big eyes
- d) Fins

22. Viper fish has high hemoglobin concentration to adapt to the...

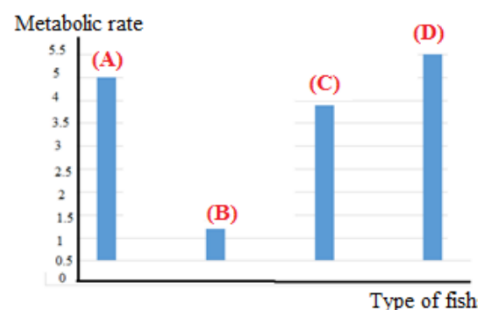
- a) Lack of oxygen
- b) High salinity
- c) High pressure
- d) Darkness

23. Which of the following is true about salmon?

- a) Young spend the first period of their lives in the sea
- b) Adult fish reproduce in river waters
- c) Adult fish spend most of their lives in rivers
- d) Young fish migrate from the sea to the river

24. The graph represents the relation between some marine fish and their metabolic rate. Could any of them choose to live in deep waters?

- a) (A)
- b) (B)
- c) (C)
- d) (D)



**25. According to what you have studied which of the following marine organisms differs from the others in the type of adaptation that distinguishes it?**

- a) Tilapia
- b) Salmon
- c) Ice-fish
- d) Dolphins

**26. Factors that lead to behavioral adaptation include...**

- a) Oxygen deficiency
- b) Water depth
- c) Reproduction
- d) Water resistance

**27. Which of the following is a common factor between structural and physiological adaptation in marine organisms?**

- a) High pressure
- b) Migration
- c) Emitting distinctive sounds
- d) Osmotic pressure

**28. Which organism demonstrates a structural adaptation that distinguishes it from others at the same taxonomic level?**

- a) Tilapia
- b) Salmon
- c) Ice-fish
- d) Dolphins

**29. Which structure primarily helps fish move horizontally in water?**

- a) Gills
- b) Fins
- c) Air bladder
- d) Scales

**30. Which of the following results from freshwater fish eliminating excess body fluid?**

- a) A contractile system that helps expel excess water
- b) Excess urine produced by the body is dilute
- c) Blood contains a high percentage of urea
- d) Openings at the top of the head



**31. Which of the following distinguishes deep-sea fish in terms of blood vessel composition?**

- a) Strong and robust
- b) Weak and thin
- c) Strong and thin
- d) Weak and thick

**32. The adaptation that includes inherited or learned actions is...**

- a) Functional adaptation
- b) Behavioral adaptation
- c) Structural adaptation
- d) No correct answer

**33. The Viper fish has flexible skeletal structures to withstand...**

- a) The high pressure
- b) Strong ocean currents
- c) Salinity of ocean water
- d) Darkness in deep ocean

**34. Deep-sea fish withstand high pressure because...**

- a) They have flexible bodies and reduced air spaces
- b) Their bones are filled with air
- c) They use lungs to equalize pressure
- d) They produce oxygen internally

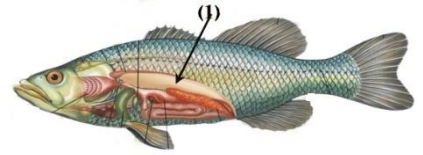
**35. Migration is an important example of behavioral adaptation in...**

- a) Whale
- b) Salmon
- c) Viper
- d) Dolphin

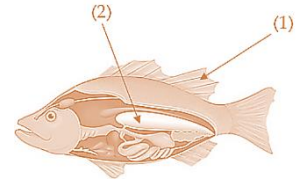
**36. In salmon fish...**

- a) Adult fish get rid of excess water.
- b) Adult fish get rid of excess salts.
- c) Young fish swallow large amounts of water.
- d) Young fish get rid of excess salts

37. What is the name of the component indicated by the arrow (1), and what is its importance in adapting to a freshwater environment?



38. In the opposite diagram mention the name and the function of the labeled organs.



39. What is the main factor that affects the amount of dissolved oxygen in water?

- a) Salinity
- b) Temperature
- c) Depth of water
- d) Wave movement

40. The photosynthesis process of aquatic producers is a source of .....

- a) Increased carbon dioxide in water
- b) Increased oxygen in water
- c) Decreased water temperature
- d) Increased salinity of water

41. When water temperature rises, the solubility of oxygen gas:

- a) Increases
- b) Decreases
- c) Is not affected
- d) Doubles

42. Which of the following gases forms carbonic acid when dissolved in water?

- a) Oxygen ( $O_2$ )
- b) Nitrogen ( $N_2$ )
- c) Carbon dioxide ( $CO_2$ )
- d) Hydrogen ( $H_2$ )

43. Marine organisms such as corals and mollusks depend on calcium carbonate to build their .....

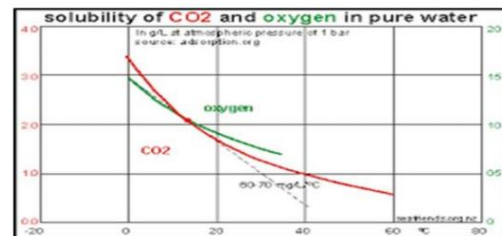
- |                       |                            |
|-----------------------|----------------------------|
| a) Internal skeletons | b) Shells and exoskeletons |
| c) Gills              | d) Fins                    |

44. What phenomenon describes the movement of gases from a high concentration region to a low concentration region?
- a) Osmosis
  - b) Diffusion
  - c) Photosynthesis
  - d) Respiration
45. Which of the following human activities directly contributes to increasing carbon dioxide levels in water bodies?
- a) Overfishing
  - b) Industrial pollution
  - c) Building dams
  - d) Coastal tourism
46. The relationship between water temperature and the solubility of carbon dioxide is:
- a) Direct
  - b) Inverse
  - c) Constant
  - d) No relationship
47. In marine organisms, the symbol  $\text{CaCO}_3$  represents:
- a) Carbonic acid
  - b) Calcium bicarbonate
  - c) Calcium carbonate
  - d) Calcium oxide
48. The atmosphere is the main source of which gas dissolved in water?
- a) Sulfur dioxide
  - b) Oxygen
  - c) Methane
  - d) Argon
49. In an artificial lake, a massive fish kill was observed on a very hot sunny day. What is the most likely scientific explanation?
- a) A large increase in photosynthesis caused water toxicity
  - b) A sharp decrease in dissolved oxygen due to high temperature
  - c) A high decrease in pH of water
  - d) An increase in salinity due to evaporation
50. If a large amount of algae is planted in a fish pond, how will the concentration of dissolved oxygen change over 24 hours (day and night)?
- a) Remains constant
  - b) Increases during the day and decreases at night
  - c) Decreases during the day and increases at night
  - d) Continuously increases



51. Some coral reefs suffer from the phenomenon known as "bleaching," which is related to the increase in ocean acidity. What is the direct cause of this phenomenon?
- a) Decrease in dissolved oxygen
  - b) Increased dissolution of CO<sub>2</sub> forming carbonic acid
  - c) Direct rise in water temperature
  - d) Pollution by heavy metals
52. In an experiment, tap water was boiled and then cooled, fish placed in it died. This is due to:
- a) Change in water pH
  - b) Loss of essential mineral salts
  - c) Expulsion of dissolved gases, especially oxygen, during boiling
  - d) Formation of toxic compounds due to heat
53. How can a factory dumping organic waste into a river affect dissolved oxygen concentration?
- a) Waste increases water temperature, which decreases oxygen levels
  - b) Waste directly consumes oxygen through chemical reactions
  - c) Waste promotes bacterial growth that consumes oxygen during decomposition
  - d) Waste prevents sunlight from reaching the water, which reduces photosynthesis and oxygen production
54. In cold regions, water is richer in dissolved oxygen compared to tropical warm regions. What is the biological result of this difference?
- a) Marine organisms in cold regions are smaller in size.
  - b) Biodiversity is higher in cold regions.
  - c) Cold regions support larger and more active marine life.
  - d) There is no significant biological difference.
55. Which of the following best describes the dual effect of increasing carbon dioxide in water on organisms with calcareous structures?
- a) It facilitates respiration and strengthens their skeletons.
  - b) It increases water acidity, hindering shell formation but providing more carbon for photosynthesis.
  - c) It lowers water acidity, dissolving shells and reducing available oxygen.
  - d) It increases pH, making shell formation easier.
56. Why are wave and wind movements important for aquatic life?
- a) They increase water depth.
  - b) They increase the surface temperature of water.
  - c) They enhance gas exchange between the atmosphere and water, increasing dissolved oxygen.
  - d) They prevent harmful algae growth.

57. In the graph showing the relationship between temperature and the solubility of oxygen ( $O_2$ ) and carbon dioxide ( $CO_2$ ), which statement is correct?



- a) The solubility of both gases increases with temperature.
- b) The solubility of both gases decreases with temperature.
- c)  $O_2$  solubility decreases while  $CO_2$  solubility increases with temperature.
- d)  $O_2$  solubility increases while  $CO_2$  solubility decreases with temperature.

58. When comparing a deep lake and a shallow lake in the same area, which one is expected to have greater daily variation in surface oxygen concentration?

- a) The deep lake, due to more water layers.
- b) The shallow lake, because temperature and photosynthesis affect a smaller volume of water.
- c) There is no difference between them.
- d) It depends on the type of fish in each lake.

59. A dense fish farm was established in a closed pond. Which of the following measures is most important for maintaining fish survival?

- a) Adding aquatic plants in abundance to increase oxygen.
- b) Installing aeration pumps (air pumps) to increase dissolved oxygen mechanically.
- c) Heating the water to speed up fish growth.
- d) Covering the pond to prevent evaporation.

60. "An increase in  $CO_2$  in the atmosphere may benefit aquatic plants but can be catastrophic for shellfish." Analyze this statement.

- a) Completely incorrect.
- b) Correct; plants use  $CO_2$  for photosynthesis, while increased acidity dissolves shells of other organisms.
- c) Partly correct; plants benefit while shellfish are not affected.
- d) Reversed; plants are harmed while shellfish benefit.

61. In a balanced aquatic ecosystem, how do  $CO_2$  levels change between day and night?

- a) Increase during the day due to animal respiration.
- b) Decrease during the day (used in photosynthesis) and increase at night (due to respiration).
- c) Remain constant due to chemical equilibrium of water.
- d) Continuously decreases throughout the day.

62. If we have two identical water tanks — one with fresh water and one with salt water at the same temperature, both aerated equally — in which tank will dissolved oxygen be higher?
- a) In salt water, because salt promotes oxygen solubility.
  - b) In fresh water, because gas solubility decreases with increasing salinity.
  - c) Equal concentration in both tanks.
  - d) Cannot be determined without knowing air pressure.
63. Some fish, like salmon, migrate to cold, oxygen-rich river sources to lay its eggs. Why?
- a) To avoid predators in warmer waters.
  - b) Because cold water provides higher dissolved oxygen levels essential for developing young fish.
  - c) Because food is more abundant in those regions.
  - d) Because water salinity is lower in river sources.
64. A 70 mg of a gas dissolves in a solvent to form a 2 L homogeneous solution at a specific temperature and pressure. So, the solubility is equal to.....
- a) 70 mg/L
  - b) 140 mg/L
  - c) 35 mg/L
  - d) 17.5 mg/L
65. All of the following are sources of water-soluble carbon dioxide except:
- a) Atmosphere
  - b) Sea creatures
  - c) Decomposition of organic matter
  - d) Photosynthesis
66. In the temperature range (20°C – 50°C), it is clear that by increasing the temperature, the:
- a) O<sub>2</sub> solubility decreases at a greater rate than CO<sub>2</sub> solubility.
  - b) The solubility of CO<sub>2</sub> decreases at a greater rate than the solubility of O<sub>2</sub>.
  - c) The solubility of both O<sub>2</sub> and CO<sub>2</sub> decreases at the same rate.
  - d) The solubility of O<sub>2</sub> and CO<sub>2</sub> is increasing at the same rate.
67. Increasing the percentage of CO<sub>2</sub> in the water works on:
- a) Increase acidification, increase calcification
  - b) Increase acidification, reduce calcification
  - c) Reduce acidification, increase calcification
  - d) Reduce acidification, reduce calcification



68. The mass of a gas that should be dissolved to a cup of pure water to form solution of volume 0.25 L, so that the solubility is 35 mg/L is equal to....
- a) 8.75 mg
  - b) 17.5 mg
  - c) 25 mg
  - d) 70 mg
69. The main source of both oxygen and carbon dioxide dissolved in water
- a) Photosynthesis
  - b) Respiration
  - c) Atmosphere
  - d) Hydrosphere
70. Which of the following causes a low pH of water?
- a) Increased  $O_2$
  - b) Increased  $CO_2$
  - c) Decreased  $O_2$
  - d) Decreased  $CO_2$
71. The volume of the resulted solution at dissolving 60 mg of a gas in pure water, so that the solubility is 40 mg/L is equal to....
- a) 0.7 L
  - b) 1 L
  - c) 1.5 L
  - d) 20 L
72. Increasing the percentage of  $CO_2$  gas in water works to convert
- a) Calcium carbonate insoluble in water to calcium bicarbonate soluble in water.
  - b) Calcium carbonate soluble in water to calcium bicarbonate insoluble in water.
  - c) Calcium bicarbonate insoluble in water to calcium carbonate soluble in water.
  - d) Calcium bicarbonate soluble in water to calcium carbonate insoluble in water.
73. What happens to the pH value at.....?
- Increasing of  $O_2$  in water / increasing of  $CO_2$  in water
- a) Doesn't change / Increases
  - b) Doesn't change / Decreases
  - c) Increases / Doesn't change
  - d) Decreases / Doesn't change

74. Define the concept of “gas solubility in water” and mention two main factors that affect it.

Gas solubility is the amount of gas that can dissolve in water at a specific temperature and pressure.

It is mainly affected by:

- a) Temperature – higher temperature → lower solubility.
- b) Salinity – higher salinity → lower solubility.

75. If you know that the wavelength of visible spectrum ranges between 400 nm : 700 nm, therefore the ratio between wavelength of red and violet spectrum equals

- a) 1/1
- b) 4/7
- c) 7/4
- d) 1/2

76. As water depth increases, the intensity of light under the water surface...

- a) gradually increases
- b) gradually decreases
- c) decreases then increases
- d) increases then decreases

77. The amount of solar energy that penetrates the water surface depends on ..... at which the sun rays strike it

- a) Intensity
- b) Angle
- c) Velocity
- d) Wave length

78. The amount of light that penetrates the water surface increases when the angle between the incident sun's rays and the water surface ..... 90°

- a) Equals to
- b) More than
- c) Less than
- d) Both a and b

79. The ascending order of light zones in water according to light intensity

- a) Twilight zone – Dark zone – Sunlit zone
- b) Dark zone – Twilight zone – Sunlit zone
- c) Sunlit zone – Twilight zone – Dark zone
- d) Twilight zone – Sunlit zone – Dark zone

80. All infrared energy from sunlight is almost absorbed by water at depth .....

- a) 100 m
- b) 100 cm
- c) 10 m
- d) 10 cm

81. At depth 10 m water absorbs greater than ..... of visible spectrum energy

- a) 95%
- b) 50%
- c) 10%
- d) 1%

82. Which of the following light colors is scattered after penetrating the surface of a water body?

- a) Warm colors
- b) Cooler colors
- c) No color
- d) All colors

83. Solar radiation as a vital factor in maintaining the ecological balance in aquatic environment because it affects .....

- a) Photosynthesis process
- b) Water temperature
- c) Distribution of marine organisms
- d) All the previous

84. In clear water aquatic plants and algae grow well down to depth of ..... meters

- a) 100
- b) 50
- c) 10
- d) 1

85. Coral reefs thrive in ..... water near the equator

- a) Depth cold
- b) Shallow cold
- c) Shallow warm
- d) Depth warm

86. Cold-water fish which live far from the equator are.....

- a) Tuna
- b) Cod
- c) Barracuda
- d) Coral

87. Some tropical fish require a specific temperature to survive and reproduce such as

- a) Cod and tuna
- b) Tuna and coral
- c) Tuna and barracuda
- d) Cod only



88. The Gulf Stream carries warm water from the equator toward the North Atlantic Ocean, which leads to .....

- a) Moderate climate in Western Europe
- b) Reduce marine biodiversity
- c) Raise temperature in these regions
- d) Leakage of food sources

89. Which of the following electromagnetic spectrum waves have the greatest energy?

- a) Radio wave
- b) X-rays
- c) Visible spectrum
- d) Gamma rays

90. A small part of electromagnetic spectrum which differ from each other in frequencies and wavelengths refers to .....

- a) Invisible spectrum
- b) Visible spectrum
- c) X-rays
- d) Gamma rays

91. The ratio between frequency of red and that of violet spectrum equals to .....

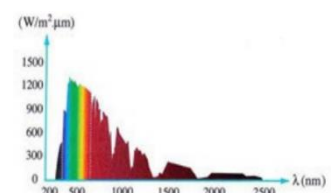
- a) 1/1
- b) 4/7
- c) 7/4
- d) 1/2

92. The visible light composed of different spectrum colors, which of the following has the maximum wavelength?

- a) Yellow color
- b) Orange color
- c) Green color
- d) Blue color

93. The opposite graph represents the relation between light intensity and wavelength, so the ratio between the intensities of the wavelengths 500 nm and 1500 nm of solar radiation at sea level is

- a) Equals to 1
- b) Less than one
- c) Greater than one
- d) No relation



**94.. The solar radiation stimulates the growth of ..... that live inside coral tissue**

- a) Symbiotic bacteria
- b) Symbiotic algae
- c) Symbiotic fungi
- d) Tropical fish

**95. Which of the following colors penetrates the deepest clear tropical water?**

- a) Red – 1%
- b) Blue – 1%
- c) Red – 50%
- d) Blue – 50%

**96. The ocean's water ..... warm color of visible spectrum as red and orange**

- a) Reflects
- b) Absorbs
- c) Scatters
- d) Disperses

**97. Solar radiation is a vital factor in retaining the ecological balance in aquatic environment, where it affects**

- a) Photosynthesis process
- b) Aquatic environmental temperature
- c) The distribution of marine organisms
- d) All the previous

**98. Autotrophic organisms such as ..... are abundant in the surface layer of water**

- a) Plants
- b) Algae
- c) Phytoplankton
- d) All the previous

**99. Explain the following statement: "The disruptions in ecological balance due to changing intensity of solar radiation within the seasonal change or climate change."**

→ Changes in solar radiation reduce photosynthesis rates in aquatic plants and algae, which decreases food availability and causes disturbances in the ecological balance.

**100. Explain the relationship between symbiotic algae and coral tissues.**

→ Symbiotic algae live inside coral tissues and receive sunlight that stimulates their growth, allowing them to provide food for the coral.

**101. Give reason: Marine organisms are distributed unevenly in the water.**

→ Marine organisms settle according to their needs for light and energy; photosynthetic organisms stay near the surface where sunlight is available.

**102. Give reason: In turbid water aquatic plants are found closer to the surface.**

→ Turbid water contains particles that reduce light penetration, so plants must live near the surface to receive enough solar radiation.

**103. Give reason: Tropical fishes such as tuna prefer to live in a tropical region.**

→ Solar radiation warms tropical waters, providing the specific temperatures needed for tropical fish such as tuna to survive and reproduce.

**104. Which of the following can flow and take the shape of the container?**

- a) solid and liquid
- b) solid and gaseous
- c) liquid and gaseous
- d) solid, liquid and gaseous

**105. Which of the following can be compressed easily?**

- a) Solids
- b) Gases
- c) Liquids
- d) Solids, liquids and gases

**106. Which of the following are measuring units of pressure?**

- a)  $\text{N/m}^2$  and Joule
- b)  $\text{N/m}^2$  and atm
- c) Joule and atm
- d)  $\text{N/m}^2$ , Joule, and atm

**107)  $2.5 \text{ atm} = \dots\dots\dots \text{N/m}^2$**

- a)  $2.53 \times 10^4$
- b)  $1.013 \times 10^4$
- c)  $1.013 \times 10^5$
- d)  $2.53 \times 10^5$

**108. If the pressure at a point inside a liquid equals  $4.052 \times 10^5 \text{ N/m}^2$ , then it is equivalent to ...**

- a) 1 atm
- b) 2 atm
- c) 3 atm
- d) 4 atm



109. Water pressure increases by approximately ..... for every 10 m below the surface.

- a) 1 N/m<sup>2</sup>
- b) 10 N/m<sup>2</sup>
- c) 1 atm
- d) 10 atm

110. Some animals can dive to a depth of 0.5 km. What is the total pressure they can withstand at this depth?

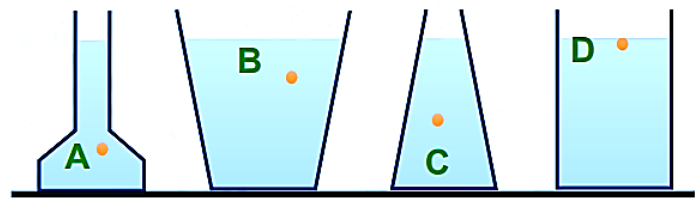
- a) 0.5 atm
- b) 1.5 atm
- c) 50 atm
- d) 51 atm

111. Which has the greatest effect on increasing the pressure at a point inside a static liquid?

- a) Increasing the surface area of the liquid
- b) Increasing the density of the liquid
- c) Increasing the viscosity of the liquid
- d) Increasing the temperature of the liquid

112. If a set of containers are filled with water, the correct order of points A, B, C, D according to pressure is:

- a)  $P_A > P_B > P_C > P_D$
- b)  $P_D > P_C > P_B > P_A$
- c)  $P_A > P_C > P_B > P_D$
- d)  $P_D > P_B > P_C > P_A$



113. What is the importance of unsaturated fatty acids in the composition of cell membranes of deep-sea fish?

- a) Increases rigidity
- b) Maintains membrane fluidity
- c) Increases permeability
- d) Reduces surface area

114. Fluids include ..... substances.

- a) solid and liquid
- b) solid and gaseous
- c) liquid and gaseous
- d) solid, liquid and gaseous

115. A liquid has a pressure at any point inside it equal to the ..... of the liquid column above that point acting on the unit area.

- a) density                      b) volume                      c) weight                      d) mass

116. What is the main advantage of the cartilaginous skeleton in fish like sharks?

- a) It provides greater strength  
b) It provides greater flexibility  
c) It makes the fish heavier  
d) It provides no special advantage

117. All the following are properties of gaseous substances except .....

- a) the ability to flow  
b) has definite volume  
c) compress easily  
d) take the shape of the container

118. Which of the following relations correctly expresses pressure?

- a)  $P = F \times A$   
b)  $P = A / F$   
c)  $P = F / A$   
d)  $P = \frac{1}{2} F \times A$

120. What is the main function of the swim bladder in fish that live at intermediate depths?

- a) Produces heat  
b) Helps in digestion  
c) Controls buoyancy  
d) Stores oxygen

121. All the following are properties of liquids except .....

- a) no ability to flow  
b) has almost definite volume  
c) resists compression  
d) takes the shape of the container

122. If the pressure at a point inside liquid equals  $151950 \text{ N/m}^2$ , then it is equivalent to:

- a) 0.5 atm                      b) 1.5 atm  
c) 2.5 atm                      d) 3.5 atm

123. How do fish living at great depths adapt to high pressure?

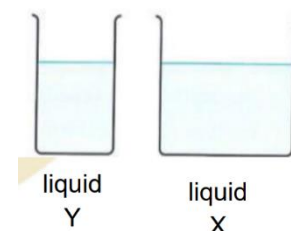
- a) By increasing the size of their swim bladder
- b) By reducing the density of their bodies
- c) By increasing their heart rate
- d) By increasing the size of their gills

124. Explain: The organisms that live near the water surface have physical or body structure less strong than those that live in the depths.

→ Because surface organisms face **relatively low water pressure**, so they do not need strong structures.

125. The diagram shows two containers with different liquids. If the density of liquid X is greater than liquid Y and the heights are equal, which liquid exerts more pressure on the base and why?

→ Liquid X exerts more pressure because liquid pressure increases with **increasing density** when depth is constant.



126. Give reason: Rays fish don't have swim bladders.

→ Because at great depths the pressure is extremely high, and a gas-filled bladder would collapse. Rays avoid this by **not having air bladder**, making them better adapted for deep water.

127. Give reason: Deep-sea fish have developed unique adaptations in their cell membranes to withstand the immense pressure at great depths.

→ They increase the proportion of **unsaturated fatty acids** in their cell membranes, which maintains membrane **fluidity and stability** under high pressure.

128. How do adaptations in cellular membranes help organisms withstand high water pressure?

→ By raising the content of **unsaturated fatty acids**, cell membranes stay fluid and stable, preventing damage from intense deep-sea pressure.

129. Compare between Bony fish (Osteichthyes) and Cartilaginous fish (Chondrichthyes):

- The type of skeleton
- Its weight
- Its flexibility
- Examples

| Type                                | Weight | Flexibility  | Examples        |
|-------------------------------------|--------|--------------|-----------------|
| Bony fish (Osteichthyes)            | Heavy  | Not flexible | Tilapia, mullet |
| Cartilaginous fish (Chondrichthyes) | Light  | Flexible     | Sharks, rays    |



# كيفية طباعة صفحات معينة من ملف معين مثلا ازاي نطبع الصفحات من صفحة 4 الى صفحة 9

